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THE

CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE.

WITH WHICH IS INCORPORATED THE "CHEMICAL GAZETTE."

A Journal of Practical Chemistry

IN ALL ITS APPLICATIONS TO

PHARMACY, ARTS, AND MANUFACTURES.

EDITED BY

WILLIAM CROOKES, F.R.S., &c.

VOLUME XXXIII.—1876.

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THE CHEMICAL NEWS.

VOLUME XXXIII.

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ON SOME FORMS OF SELENIUM, AND ON THE INFLUENCE OF LIGHT ON THE ELECTRICAL CONDUCTIVITY OF THIS ELEMENT.*

By HARRY N. DRAPER, F.C.S., and RICHARD J. MOSS, F.C.S.

In a paper read before the Society of Telegraph Engineers† on February 12th, 1873, Mr. Willoughby Smith announced the remarkable fact, that a bar of crystalline selenium, through which a current of electricity passes, has its conductivity increased 15 to 100 per cent when the bar is exposed to light. The light from an ordinary gas-burner placed at a distance of several feet increased the conductivity 15 to 20 per cent. Mr. Smith satisfied himself that alterations in temperature in no way affected this result, by placing the selenium in water, in such a manner that the light from burning magnesium ribbon held some inches above the bar passed through about an inch of water before falling upon the selenium. Under these circumstances, the conductivity of the bar was found to increase more than two-thirds, returning to the normal conductivity when the light was withdrawn.

Lieutenant Sale, in a communication made to the Royal Society,‡ describes a series of experiments undertaken with the object of ascertaining the relative effect upon the electric resistance of selenium of the light in different parts of the spectrum. He found that in the solar spectrum the conductivity is least in the violet, and increases as the red is approached, attaining its maximum in a position just on the outside edge of the red rays at the red side. The conductivity in this position is greater than in diffuse daylight, but very considerably less than when the selenium is exposed to full sunlight. Mr. Sale observed that the effect of light is apparently instantaneous, but that the return in darkness to the normal resistance is not so rapid. He corroborates the statement of Mr. Willoughby Smith, already cited, that the varying resistance is in no way due to alteration of temperature of the selenium.§

Soon after the publication of Mr. Smith's observations, we undertook a series of experiments with the object of, if possible, determining the precise molecular state of selenium, which exhibited this phenomenon of diminished electrical resistance under the action of light, and the conditions necessary for its production.

It would here appear necessary to give a brief *resumé* of the state of our knowledge of the physical properties and relations of selenium. This is of the more importance because little, if anything, has been added to that knowledge for nearly twenty years, and because the statements in some of the acknowledged text-books are not only insufficient, but often discordant with the results obtained by the *savants* to whom we owe all that up to this time has been done in relation to the subject.

As we would desire to avoid matter which is supplied by handbooks of chemistry, or details not directly bearing upon our investigation, it must be understood that we note here only those hitherto observed and not widely known characters of selenium which seem to us to be in ntimate relation to the phenomena we have made the iobjects of experiment.

Selenium, discovered by Berzelius in 1817, was carefully studied by that chemist, and it is through his researches, and those of Regnault, Mitscherlich, and Hittorf, that we have almost all our knowledge of the physical characters of this element. It is upon their authority that the following statements are made.

Selenium may exist in several different forms:—

1. As a vitreous mass, with conchoidal fracture.

2. As a red amorphous powder precipitated from selenious acid or selenites by the action of reducing agents.

3. In the form of minute crystals deposited from its solution in bisulphide of carbon.

4. In crystals deposited from solutions of the alkaline selenides exposed to the air.

5. As a granular body resembling, almost completely, metallic cobalt or cast-iron, and obtained by the heating and slow cooling of either of the three first-mentioned forms.

The first three modifications, it should be mentioned, resemble one another in their physical and chemical relations, and must be regarded as different conditions of the same allotropic form of selenium.

It is here only necessary to speak of vitreous selenium and of its heat-produced allotropic modification, the granular variety, or as it has been felicitously called by Regnault, metallic selenium.

Vitreous selenium has no definite point of fusion. At temperatures exceeding 60° C. it softens, becoming gradually softer with increased heat, and being perfectly fluid at 250°. When rapidly cooled from this temperature, it returns to its original condition. At normal temperatures it may be kept without change of state for many years, and is probably under these conditions perfectly stable. It is, though very sparingly, soluble in bisulphide of carbon. In thin films, it appears by transmitted light of a beautiful ruby-red colour. Its specific gravity is, according to Schaffgottsch, 4·276.

When this vitreous selenium is maintained for some time at any temperature between 94° and 200° C., and is then slowly cooled, it is found to have assumed a metallic ap-

* From the *Proceedings of the Royal Irish Academy*, vol. i., Ser. II. (Sci.).

† *Nature*, vol. viii., p. 203.

‡ *Proceedings of the Royal Society of London*, vol. xxi., p. 283.

§ No experiments are adduced in support of this statement.

pearance, and to have a grey granular fracture. It is now, we ourselves find, perfectly opaque to light, even in the thinnest films. Its specific gravity has increased to 4·796. When heated it does not soften, but at 217° fuses without taking any intermediate pasty condition. At 250° it is perfectly fluid, even when the mass is considerable; and when rapidly cooled returns, without any tendency to crystallise, to the vitreous, non-metallic modification. All that has up to the present been made known as to the electrical relations of selenium may be very shortly told.

Solid vitreous selenium cannot, according to Berzelius,* be rendered electrical by friction, but, on the contrary, Bondsdorff† states that when rubbed in very dry air it has this property.‡ Knox found that fused selenium conducted the current of a battery of sixty pairs. Hittorf§ found that granular selenium at normal temperatures conducted sufficient of the current of one Grove's element to deflect the astatic needle of a galvanometer having 200 convolutions 17°, and that when the selenium was heated to 210° in a small crucible the needle marked 80°. But when the temperature reached 217° (the point of fusion of granular selenium), the needle went back suddenly to 20°.

The action of light as probably effecting some change in the allotropy of selenium was not wholly unsuspected prior to Mr. Smith's observations. Gmelin mentions exposure to sunlight as a favourable condition for the precipitation of selenium from dilute solutions of selenious acid by sulphurous acid; and Hittorf, while noting the likelihood of such an influence, was unable to detect it, and was obliged to attribute the observed change of amorphous into crystalline selenium, while drying in sunlight, entirely to the effect of heat. In pursuing the line of research we have marked out for ourselves, we have been obliged to repeat much already published work, which with improved means of experiment has lost somewhat of its significance. We have thus encountered several apparently contradictory statements, some of which our experience has either failed to verify, or has placed in a new light; and we have been convinced that the properties of this remarkable substance are but imperfectly understood, and still present a wide field for investigation. Vitreous selenium is, we should say at the outset, apparently an absolute non-conductor of electricity. We have been unable to obtain any deflection of the very sensitive astatic needle of a high resistance galvanometer, when the thinnest films of selenium, of the continuity of which we could assure ourselves, are interposed in the circuit of ten Leclanché elements. The difficulty of producing very thin films of absolute continuity disposes us nevertheless to state our belief as to the complete non-conductivity of vitreous selenium with some reservation.

As might be expected from this character, selenium in the vitreous form becomes electric by friction. So easily indeed have we invariably obtained this result that we find it difficult to understand the contrary conclusion of Berzelius.

Hittorf, as has been stated, found that when vitreous selenium is converted into the granular form its electrical resistance diminishes directly with its temperature, but that when 217° is attained the resistance is suddenly and largely augmented. In repeating this experiment we have obtained results concordant with those of Hittorf, who appears, however, not to have exceeded the temperature of 217°. Going beyond this point, we find that the resistance diminishes up to the point of complete fusion of the selenium, being at its maximum at 250°. We have obtained also the remarkable result that when the vitreous selenium resulting from the rapid cooling of the completely fused granular form is quickly heated, it begins to conduct the current at a temperature between 165° and 175°, and that its resistance diminishes, not only up to the extreme range of the mercurial thermometer, but so much beyond that it is still diminishing when, owing to the rapid volatilisation of the selenium, it has been found necessary to terminate the experiment.

It has hitherto been assumed that there is but one granular form of selenium, and that this is a conductor of electricity. We have, however, obtained a granular form in no way optically differing from granular selenium of comparatively low resistance, through a rod of which, 16 m.m. long and 3 m.m. diameter, the current of ten Leclanché cells does not in the least deflect the needle of our highly sensitive galvanometer. Nor does light, so far as our experiments have yet gone, diminish the resistance of this modification. We have, on the other hand, succeeded in obtaining bars of granular selenium through which the current of one Leclanché cell causes a very considerable deflection of the needle. This form is, we find, in its electric resistance almost unaffected by light. Between these two forms of granular selenium—the apparently non-conducting and the comparatively highly conducting—there is another of intermediate resistance. This modification is highly sensitive to light; its conductivity when in the form of flat bars increasing in direct sunlight 75 to 100 per cent, and in artificial light in ratios ranging from 10 to 50 per cent.

One form of granular selenium, as Hittorf first showed, has its resistance considerably diminished by heat: indeed, he says that could it be heated red hot its conductivity would not be inferior to that of the metals. Our own experiments confirm the diminution of conductivity by heat, but we have found, in at least one modification which we have produced, a body which so far conforms to the metallic type as to have its resistance strikingly increased by heat. We have made bars of selenium which when placed in the circuit of a battery and galvanometer, have shown a deflection of 48°, while upon completing the circuit of a nitric acid battery, the current of which heated a spiral platinum wire surrounding the bar of selenium, the needle gradually fell to 15°, as the temperature of the bar became greater.

For the present we refrain from comment upon these results; and although we have been engaged during many months in this investigation, we defer details of our experiments, and especially of the conditions under which the different electrically resisting and light-sensitive forms of selenium are obtained, until with larger experience we may hope to bring before the Academy results tending more closely to the solution of the questions we have proposed to ourselves.

* Gmelin, "Handbook," ii., p. 236.
† Gmelin, *l.c.*
‡ Gmelin, *l.c.*
§ Poggendorf, *Annalen der Physik und Chemie*, Bd. lxxxiv., p. 214.

ON PYROLOGY, OR ANALYSIS AND SYNTHESIS BY MEANS OF THE BLOWPIPE.*

By W. A. ROSS.

(Continued from vol. xxxii., p. 252.)

(7). It seems incredible, and yet is undoubtedly a fact, that there are English chemists—accomplished ones too—and even public analysts almost entirely ignorant of the analytical use of the blowpipe. To foreigners, especially Germans, it seems strange that we have not in England any *systematic* training, by means of lectures and practical teaching, in blowpipe analysis, on the pattern of the famous Freiberg University. Such a course might surely be instituted by a rich Government like ours without much difficulty, in Jermyn Street, under the direction of one of the old Freiberg students, as, for instance, Her Majesty's Inspector of Mines, within whose superintendence the students might make periodical visits to the most characteristic mines, which that gentleman knows so well: so that this reproach may be taken from us. It

* The term "pyrological" ("pyrologischen Versuche") has been adopted by Professor Richter, of Freiberg, in a letter to the writer.

is not a sufficient reply to say that "there *is* a course of blowpipe instruction in almost every English chemical class or college." Every chemist who has been to Freiberg, or even to the American colleges, knows how inefficiently the blowpipe is taught, or rather, how effectually it is neglected in our otherwise excellent schools of chemistry. If this point be controverted, it will not be difficult to take one of our most generally received analytical text-books, and show what extraordinary and incorrect statements are there made with regard to blowpipe analysis, nor does an inspection of some of the English pyrological instruments and apparatus at all reassure us. I have lately, incredible as it will seem, been shown an instrument as the *only* kind of blowpipe in use in a public laboratory in London, having an aperture at the jet, *at least a quarter of an inch in diameter;* and, to make matters worse, filled both with the blast and with aërated coal gas! I saw a youth blowing through such a machine as this by means of a mouthpiece cleverly extemporised with a glass funnel, and warned him that he would thus probably injure his lungs, a misfortune which would of course be attributed to "the blowpipe," instead of to the personal use of such a *tuyere* as this.

(8). It may be as well to mention here that blowpipes like that devised by Von Frick, having the operator's breath, or blast from any other source, and the gas for ignition conveyed by the *same* tube, are utterly useless for these purposes; that Bunsen burners are useless for these purposes; that Fletcher's most ingenious, and no doubt otherwise invaluable "hot blast blowpipe" is almost useless for these purposes, which are most erroneously supposed to be *always* best effected by the greatest heat. Let any student who really wishes to learn this science produce a blue pyrocone from a candle by a hand blower, and then with a mouth blowpipe held in the other hand, direct a blast *across* this blue pyrocone, so as to dissect it; he finds it to be a *solid* mass of blue flame. If he now perform the same operation on the pyrocone from a gas jet, the pyrocone is found to be slightly hollow, while the pyrocone from a Bunsen burner has only the merest thin shell of circumscribing ignited gaseous matter. It is obvious, therefore, that the effect of holding the fragment or paste of a mineral or other essay, in the middle of these three pyrocones, must be different in each case; yet how seldom in England do we see a candle or oil lamp used for important results which can be obtained *solely* by its use?

(9). It is obvious that in order to properly systematise the science of blowpipe analysis, we ought to reduce it to as close analogy as may be with the procedure in ordinary chemical analysis, which has been found to answer so well. I have, therefore, in my method discarded the preliminary use of the *salts* borax and microcosmic salt, and commenced attacking substances with the pyracids "Boric and phosphoric anhydride." *Boric acid*, indeed, contrary to the account found in most of our chemical works, dissolves before the blowpipe no oxide whatever completely, except those of the alkaline metals, and that of silver a little, but its reactions thus are a thousand times more valuable than if it really (as we are told) dissolved all those, while, by adding pyrologically a *very small* proportion of alkali (not quite 5 per cent) we obtain a still acid menstruum which is itself extremely soluble in water. *Phosphoric acid*, on the other hand, is, before the blowpipe, the most powerful unmixed solvent in the world, dissolving gold leaf to a bluish violet glass quite rapidly. In either case we can further, if we like, obtain an acidulated water solution, in which precipitates can be produced by alkalies, &c., just as in "the wet way," but this process requires to be worked out, and shall not therefore be further alluded to here.

(10). It is necessary, however, to lightly touch upon one part of the subject, not invidiously but conscientiously, before proceeding to details. However invaluable the application of the symbolical and algebraical process of ratiocination may be, assuming its groundwork of facts to be correct, to what may be termed the metaphysical chemistry of modern times, it seems insufficient when absolutely and completely substituted for practical knowledge, and reasoning in mere English,* and, indeed, it is obvious that, in England at least, there is a tendency among our best writers, even on chemical metaphysics, to express their thoughts, not only in English, but in the very plainest English which has ever been in the possession of Her Majesty or her predecessors. There is no art so difficult of attainment as simplicity, and we may safely regard the value of an invention (or the description of one) in the inverse ratio to its complication. Whoever takes the trouble to compare the amazing hieroglyphical work of the communistical chemist Nacquet, translated into English the other day, with the luminous "essays" of the marvellous apothecary Scheele;† or Axiom V., Book I. of Newton's Optics, on the ratio between the sines of incidence and refraction in a ray of light, with the ordinary scientific account of the same simple law given in our modern mathematical or physical works, will soon see that the advantage in every essential particular remains with the adopters of expression by means of language. Besides, no one, not even the most eminent philosopher, can afford to discard the very great advantage of addressing himself to thousands—perhaps millions—of his fellow creatures, instead of to a few transcendentalists who cannot spread his opinions beyond their own clique.

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.‡

By Dr. A. W. HOFMANN.

(Continued from vol. xxxii., p. 286.)

THENARD, on bringing peroxide of hydrogen into contact with his tongue, in order to ascertain its taste, found that it was whitened. The cuticle was also blackened, and at the same time a violent itching was excited. Litmus paper without any previous reddening was at once decolourised, as was also turmeric paper.

In 1863 Chevreul‖ undertook comparative experiments on the bleaching power of hydrogen peroxide. Its concentrated solution speedily turned syrup of violets green, oxygen being set at liberty. For the following experiments dilute colour-solutions were used—namely, syrup of violets, tincture of litmus, extract of peach-wood, and extract of logwood. The results were as follows:—

Time.	Violets.	Litmus.	Peach-wood.	Logwood.
10 mins.	Imperceptible.	Slight bleaching.	Change to rose.	—
24 hrs...	Complete bleaching.	Almost complete bleaching.		Turns yellow.
80 hrs...	Complete bleaching of all the solutions.			

Decolorisation is therefore effected less rapidly by peroxide of hydrogen than by chlorine. Tessié du Motay and Maréchal§ mention it as one of the agents which they propose for bleaching tissues, which, after treatment with permanganate of potash, they recommend to be steeped in a solution of peroxide of hydrogen. But it had been much earlier applied as a bleaching-agent by Thénard¶ himself for a particular purpose—namely, for restoring old

* The controversy at present proceeding between Dr. Frankland and Mr. Wanklyn in the CHEMICAL NEWS, with reference to water analysis, may be cited as an illustration of this point.

† Scheele seems to have been a German, not a Swede, settled as a common apothecary, at Köping, in Sweden.

‡ "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzehends."

‖ Chevreul, *Comptes Rendus*, lv., 735.

§ *Bull. Soc. d'Encouragement*, 1867, 472. Dingler, *Polyt. Journal* cxxc(?)iv., 526.

¶ Pelouze and Frémy, *Traité de Chimie*, 1861.

oil-paintings and drawings. White-lead in old paintings, which has become blackened by the gradual action of sulphuretted hydrogen, is converted into sulphate of lead by dilute solutions of peroxide of hydrogen, and thus restored to its primitive colour. A fine drawing by Raffaelle, with superimposed white which had become spotted with black, was completely cleansed by a solution which contained at most five or six times its volume of available oxygen, and the paper did not suffer.

A peculiar, hitherto secret, application of this bleaching-agent has been recently made public by A. v. Schrötter.* During the last few years bottles labelled "Eau de Fontaine de Jouvence, golden," and containing about 140 c.c. of a colourless liquid, have been sold by perfumers in great cities. The price demanded is about 20 francs, and to them, as it appears, is due that offensive blonde shade of hair which holds an intermediate place between ash-grey and bright yellow, and attracts the attention of the spectators and the curiosity of observers by its *piquante* unnaturalness. According to Schrötter this secret nostrum is merely a solution of hydrogen peroxide made stable by copious dilution, and by addition of a small quantity of acid,—apparently nitric acid. According to Schrötter's careful examination it contained 6 volumes of available oxygen: 1000 grms. of the liquid would therefore contain 8·6 of available oxygen, or 18·3 of peroxide of hydrogen. As may be imagined, however, in case of an easily decomposable body, the bottles do not all contain solutions of equal strength. An examination conducted in the laboratory of the University of Berlin showed, in 1 volume of the solution, 9·4 to 9·8 vols. of available oxygen, corresponding to 13·6 grms. O, or 28·9 grms. H_2O_2, per litre. A bottle costing 20 francs yields the purchaser 2·5 to 4 grms. of this substance in solution, and effects its purpose completely, though slowly, within four to six days, thus strikingly illustrating the great efficacy of peroxide of hydrogen. The name of the perfumer who understands how to speculate so successfully upon the purses of his fair contemporaries, and who deserves to be known to posterity, is E. H. Thiellay, of London.

* *Berl. Chem. Ges.*, 1874, 980.

ON AN INSTRUMENT FOR MEASURING THE DIRECT HEAT OF THE SUN.†

By Prof. BALFOUR STEWART, LL.D., F.R.S.

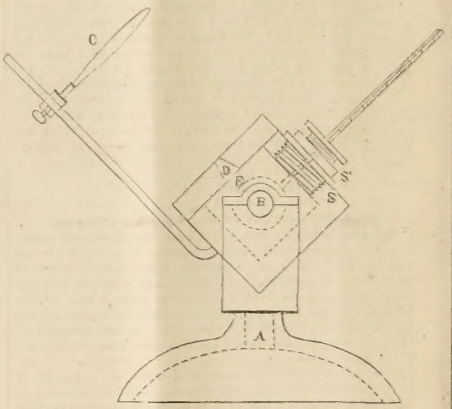
† A Paper read before the Manchester Literary and Philosophical Society.

THE instrument generally employed for giving the radiant energy of the sun's rays acts upon the following principle. In the first place the instrument is sheltered from the sun but exposed to the clear sky, say for five minutes; let the heat so lost be termed r. Secondly, the instrument is turned to the sun for five minutes; let the heat so gained be termed R. Thirdly, the instrument being now hotter than it was in the first operation, is turned once more so as to be exposed to the clear sky for five minutes while it is shielded from the sun; let the heat so lost be termed r'. It thus appears that r denotes the heat lost by convection and radiation united when the instrument, before being heated by the sun, is exposed for five minutes to the clear sky, while r' denotes the heat lost by these same two operations by a similar exposure after the instrument has been heated by the sun; and it is assumed that the heat lost from these two causes during the time when the instrument is being heated by the sun will be a mean between r and r', and hence that the whole effect of the sun's rays will be in reality—

$$R+\frac{r+r'}{2}.$$

Now although this assumption may in the average of a great number of experiments represent the truth, yet in many individual cases it may be far from being true. It would therefore seem to be desirable to get rid of this uncertainty by constructing an instrument in which we are sure that the causes of variability are not allowed to operate.

These causes of variability I have attempted to get rid of in the following manner. With the help of Mr. Jordan, mechanician at Owens College, the following instrument has been constructed. It consists of a large mercurial thermometer with its bulb in the middle of a cubical cast-iron chamber, this chamber being of such massive material that its temperature will remain sensibly constant for some time. The chamber with its thermometer has a motion in azimuth round a vertical axis, A, and also a motion in altitude round a horizontal axis, B. A three inch lens, C, of 12 inches focal length is attached by means of a rod to the cubical chamber so as to move with it. The nature of this attachment will be seen in the figure. Thus the whole instrument may be easily moved into such a position that the lens as well as the upper side of the chamber which is parallel to the plane of the lens may face the sun, and an image of the sun be thrown through a hole, D, in the side of the chamber upon the thermometer bulb, E.



The stem of the thermometer protrudes from the chamber as in the figure. A screw, S, somewhat larger in diameter than the bulb of the thermometer is made use of to attach the thermometer to its enclosure, and a smaller screw, S', pressing home upon india-rubber washers enables the thermometer to be properly adjusted and kept tight when in adjustment.

In the present instrument the internal diameter of the chamber is 2 inches, while the bulb of the thermometer is about 1¼ inches in diameter.

The scale of the thermometer is very open, more than an inch going to one degree. I have generally allowed the image of the sun given by the lens to heat the thermometer bulb for one minute, during which time an increase of temperature, not exceeding in any case two degrees, has been produced.

As far as principle is concerned there appears to be no objection to the present instrument, nevertheless it is open to a very serious practical objection. The scale being so very open, the stem comprehends only a few degrees; frequently, therefore, the temperature is such that the extremity of the mercurial column is either below or above the stem. Now the thermometer has a small upper chamber, and by means of a method of manipulation well known to those who work with thermometers, it

s possible to add to or take away from the main body of mercury in the bulb so as to keep the end of the mercurial column always in the stem. But experience has convinced me that for a thermometer with such a large bulb, frequent manipulation of this kind is not unattended with danger to the bulb. On this account the instrument in its present form is, I conceive, unsuited for steady work in an observatory from year to year.

It is, however, possible without any appreciable sacrifice of the scientific principle of the instrument, to alter it in such a manner as to remedy this defect. Without altering the size of the bulb, I should propose for a permanent instrument a stem, say 18 inches long, with a bore of such diameter that the stem should embrace a range of temperature between 20° F. and 92° F. Thus somewhat less than 5 will go to the inch. The stem might be protected from the risk of accident by an appropriate shield. Let such a thermometer be heated for two minutes and the size of the lens be somewhat increased. In this case a rise of something like 5° F. will be obtained, and this heating effect might very easily be estimated to one-hundredth of the whole, while the same thermometer would serve for all the temperatures likely to occur in these islands during the course of the year.

I ought to add that a pasteboard cover gilded on the outside is made to surround the chamber, and also that between the lens and the chamber there is a pasteboard shield with a hole in it to permit the full rays from the lens to pass—the object of this shield being to prevent rays from the sun or sky from reaching the instrument.

In such an instrument r or the change taking place in the thermometer before exposure to the sun will in all probability completely disappear, while r' will be extremely small. At any rate we may be quite certain that—

$$R+\frac{r+r'}{2}$$

will accurately represent the heating effect of the sun.

We may probably suppose that in the same instrument the lens (which must always be kept clean) will always stop the same or nearly the same proportion of the solar rays. But the lens of one instrument may not stop the same proportion as that of another instrument. This, however, is no objection if it be borne in mind that the instrument is a differential one. In practice there would be some standard instrument which would be retained at a central observatory, and all other instruments would, before being issued, be compared with it. It would be thus possible to compare together the indications of various instruments working in different places provided that these, before being issued, had their co-efficients determined at the central observatory.

LABORATORY NOTES.

By SERGIUS KERN, St Petersburg.

(1). *On a Reagent for Uranium.*—With potassium ferrocyanide (K_4FeCy_6) a solution of a uranic salt yields a brown precipitate of uranium ferrocyanide. The precipitate obtained much resembles the precipitate of copper ferrocyanide, but may be distinguished by the solubility of the precipitates in hydrochloric acid, viz., the uranium ferrocyanide dissolves easily even in diluted hydrochloric acid: the corresponding copper salt is insoluble in acids. This reaction may be used for the separation of copper from uranium. The uranium ferrocyanide dissolved in hydrochloric acid with a few drops of nitric acid gives a *green colouration* after being boiled for some minutes: this reaction is proposed as a test for uranium salts.

(2). *On the Use of Cuprous Oxide.*—This compound is easily prepared by boiling a solution of copper sulphate with sugar and an excess of caustic potash. As the cuprous oxide (Cu_2O) obtained in the form of a red powder is soluble in ammonia and absorbs readily free oxygen, it is proposed to substitute it for the expensive pyrogallic acid now used in laboratories for the absorption of oxygen. Pyrogallic acid must be very carefully preserved, an account of the great avidity of this substance for oxygen, whilst cuprous oxide may be easily conserved in a dry state and when necessary dissolved in ammonia. A solution of cuprous oxide in ammonia absorbing oxygen gas turns blue, owing to the formation of cupric oxide (CuO). The solution of cupric oxide obtained may be again converted into a colourless solution of cuprous oxide (Cu_2O) by placing in the liquor a clean copper wire. The formula $CuO+Cu=Cu_2O$ explains this reaction.

ANALYSIS OF "TELL-TALE SUGAR LIQUOR" FROM THE SAFES OF TWO VACUUM SUGAR PANS.

By G. C. STEWART, F.C.S.,

Chemist at the Cappielow Sugar Refinery, near Greenock.

All vacuum sugar pans (exceptional instances overlooked) are furnished with "tell-tale sugar liquor" safes for catching any "sugar liquor," &c., which might accidentally or peradventure "otherwise" boil over during the evaporating process in sugar refining.

These safes yield, when emptied, solutions which may vary in chemical composition according to a great variety of circumstances. First of all, the mechanical construction of the pans may have a great deal to do with this, as has also the position in which the safe itself is fixed. If the pan is low set and very short in the swan's neck, ten to one but that the "liquor" drawn from the safe of such a pan will be found upon analysis to be much richer in "sugar" and other organic matter than the "liquor" drawn from another pan high set and very lofty in the swan's neck.

Such is the case, and occasionally in sugar-boiling, when too much "salt" water is given to the condenser during the evaporating process, it not unfrequently happens that this excess of salt water finds exit by "more roads than down the Torricellian tube."

When such an accident occurs, the "liquor" drawn from the safe will be found upon analysis to be almost "salt water," and will actually taste salt.

By keeping up a continual examination of the "liquors" drawn from these safes day after day, a good idea will be formed by the chemist in charge of the sugar refinery as to how the pans are being handled by the pan-men.

The following two analyses of this "liquor" will be examined with curiosity by your numerous readers who take a direct interest in the literature of the subject.

100 parts by weight contain:—

	No. 1. Per cent.	No. 2. Per cent.
Crystallisable sugar	4·80	11·43
Fruit sugar	3·37	4·52
Extractive organic matter	1·76	1·54
Insoluble matter	0·56	0·08
Soluble salts	2·57	0·60
Iron	0·26	0·45
Copper	0·21	0·05
Water	86·47	81·83
	100·00	100·00

No. 1.—This "sugar-liquor" is from the safe of a modern vacuum sugar-pan recently constructed, high in the swan's neck, and of artistic mechanical design.

No. 2.—Is the same "liquor" drawn from the safe of an old-fashioned vacuum sugar pan, low set, short in the swan's neck, and as old as Howard.

NOTICES OF BOOKS.

Third Annual Report of the Board of Healths of the City of Boston. 1875. Boston: Rockwell and Churchill.

This issue contains no small amount of important and interesting matter. There is a paper on the ventilation of schools by Dr. F. W. Draper, which takes up a subject hitherto neglected by sanitary reformers. Prof. W. R. Nichols took samples of air in 111 school-rooms and submitted them to analysis. The proportion of carbonic acid ranged from 3 volumes in 1000 to 0·57, with a general average of 1·18. The greatest amount compatible with a healthy condition of the atmosphere is fixed by Professor Pettenkofer at 0·7; the carbonic acid being regarded not so much as a dangerous body *per se*, but as the measure of contamination in an occupied room as arising from organic products thrown off from the lungs and skin. It need scarcely be said that an apartment where the carbonic acid rises to 3 parts in 1000 is a most unfit place for children to spend some five or six hours daily. The means employed, often the only means provided, to remedy this state of things is merely an additional evil. The windows are thrown open, and, as Dr. Draper puts it, "the inevitable wave of cold outside air sweeps over the uncovered heads of the children and a fresh accession of cases of bronchitis, or of more serious pulmonary affections, is the result." In the inspection of the "Chapman school, a room showed at the desk-level a temperature of 77°; three quarters-of-an-hour later the same room was revisited, when the thermometer indicated 61·7, a fall of 15·3. Between the two visits the teacher had 'aired' the room to some purpose; the air was pure enough, and the coughing and sneezing of the children gave warning that it was cold enough also. If such a sudden change should occur in the outside atmosphere it would be considered a fruitful cause of increased sickness in the community." We greatly fear that were similar investigations undertaken in England the results would be found not more satisfactory than those given in the report before us. It is at least certain that too many school-houses, instead of broad windows admitting those floods of light for which children instinctively crave, are provided with narrow, mediæval loop-holes, calculated to admit only a dim mysterious light, symbolical of anything but intelligence, and eminently calculated to make the pupils uneasy and fretful.

From the sanitary condition of schools we pass to a paper on the sewage question by Dr. W. L. Richardson, who appears to have swallowed the *ex parte* statements of certain English irrigationists without the time-honoured grain of salt recommended on such occasions. Thus he tells us that the existence of sewage farms, so far from being detrimental to the health of the vicinity, has actually a beneficial effect. As proof of this statement—and incidentally we must add, as a confirmation of the remark that statistics can prove anything—he quotes from Dr. Corfield the case of Norwood, where, thanks to the establishment of a sewage farm, the mortality has fallen from 18 to 12·07 per 1000. *Post hoc, ergo propter hoc?* "This improved death-rate is of course to be attributed to the increased vegetation produced by sewage irrigation." If luxuriant vegetation necessarily implies a low death-rate, what do we say to the Terai, the west coast of Africa, the tierras calientes of Mexico, to rice-fields and mangrove swamps? Admitting, for argument's sake, the Norwood case, we cannot overlook the facts detailed in the official report on Progress of India, for 1871 and 1872, by C. R. Markham, C.B. Here it appears that the epidemic of 1847 was more severe and more general in the irrigated districts than elsewhere. A medical committee of inspection recommended that irrigation should not be brought within 200 yards of the villages, and that the latter should be screened by a double row of trees, planted around the irrigated lands. If such are the effects of irrigation with clean water, applied, moreover, only when needed by the crops, what must be the results of irrigation with sewage, carried on day by day? It must be clearly understood that if we pour any volatile liquid even upon the most perfect filter, evaporation takes place from the surface. If we keep the surface constantly moist, the evaporation is continuous, and if the liquid hold in solution any sewage gases these, too, must as by physical necessity be delivered into the atmosphere. Between a sewage farm and a polluted river there is simply this difference, that the former exposes a far broader evaporating surface. The vicinity of a sewage farm may here and there, for a few years, appear healthy. But just the same may be said of certain places where the utmost sanitary neglect prevails. We could point out villages where the only supply of water is either from shallow wells, separated from cesspools by only a few yards of chalk and gravel, or from roadside duck-ponds, receiving the drainage of cultivated lands and the oozings of farmyard dung heaps. Yet the death-rate is low, and the inhabitants healthy. Are we not from time to time informed of the health and vigour of nightmen, scavengers, knackers, bone-boilers, and others who are constantly engaged among putrescent matter? Are their no hale old gentlemen who have all their lives quaffed the waters of some City pump, sparkling with carbonic acid due to decomposing animal substances, and whom no physician nor chemist can convince of its unhealthiness? Such cases as that of Norwood either prove nothing or a great deal too much. If a sewage farm is healthy, sanitary reform is a needless luxury.

As to the "astounding results"—which are slow in taking the form of hard cash,—the "enormous crops," and the "most luxuriant vegetation," the eyes of the public are gradually being opened. At first we were told that sewage irrigation would render the application of manure superfluous; then it appeared that the dung of the stock kept upon the farm must be added; and now we find that the green crops are to be ploughed in to enrich the soil! Dr. Richardson exaggerates when he says that precipitation processes allow *all* the soluble matters in the sewage to escape with the effluent. He forgets, too, that of the combined nitrogen present in the sewage, a large part, varying from a quarter to two-thirds, goes off in the drainage from the irrigation farms. So that precipitation and irrigation alike fail to secure all the valuable matter contained in sewage. That in India and other hot, dry countries irrigation is often the one thing wanted to convert a desert into a garden, we fully admit. But in England, in average seasons, it is quite as clearly the one thing which is not wanted.

The report further contains the yearly results of the chemical examination of articles of diet, medicines, &c., as executed by the able chemist to the Board, Dr. W. R. Nichols. Special notice is given of a class of quack medicines largely sold under the name of bitters, but containing large proportions of alcohol, in one case as much as 59 per cent.

CORRESPONDENCE.

SAMPLING OF MILK FOR ANALYSIS.

To the Editor of the Chemical News.

Sir,—Since the Sale of Food and Drugs Act came into operation, I have observed on several occasions that the mode of taking and dividing the samples of milk supplied to the analyst has an important influence on the comparative results of analyses made for the determination of the fat. I am sometimes called upon to analyse not only the sample left with me by the inspector, but also that left with the dealer, who is naturally anxious to know the result quickly instead of remaining in suspense, it may be, for weeks; and I have not unfrequently found,

under such circumstances, that the two analyses have differed in regard to fat to the extent of five or ten hundredths of a per cent. This difference I have traced to the method adopted by the inspectors in dividing the samples. The milk, when purchased, is put into a jug, and from this three bottles are filled. Many minutes often elapse between the making of the purchase and the subsequent dividing and sealing of the samples, during which time a partial separation of cream takes place, to an extent depending on the condition of the milk at the time, and, as a consequence, the bottle first filled will contain a milk somewhat richer in butter than the others. This difference would not have occurred in the divided samples obtained as they used to be under the old Act, for each sample was then taken in a bottle to the analyst, and by him divided after having been thoroughly mixed by shaking, which can be done in a bottle but not in a jug.

I have also found a want of accordance in the results of milk analyses arising from another and very different cause. I have been anxious to satisfy myself as to the usual amount of reduction in the proportion of fat which takes place in large vessels from which milk is being dipped out for sale both by retail and wholesale; and having had several experiments made in which milk has been dipped in successive quantities out of the tin churns containing about 16 gallons, and also out of the counterpans or tureens containing about 10 gallons each, I have found that when such quantities of milk have, by successive dippings, been divided into two parts, one consisting of what has been dipped out, and the other of what remained, on taking a sample from each as a milkman would take it, and estimating the fat, the mean of the two extremes has not coincided with the proportion of fat contained in the original milk. In fact, it is impossible, in dealing with large quantities of milk, as the milkmen do, and using the same vessels, to get concordant results of that description. I have always found the mean of the extremes to be below the quantity present in the original sample, if in taking the sample the measure or dipper be plunged in vertically to the depth of an inch or two below the surface, for in that case the richer stratum of milk and cream on the surface is broken and dispersed and the measure filled from the poorer portion beneath.

A milkman can easily supply a sample of milk from a counter-pan that shall be either richer or poorer in fat than a fair average sample of the whole would be by varying the mode of taking it, but it would be impossible, in the usual mode of serving milk, to ensure that the sample shall represent the mean of the whole.

My object in communicating this note is to show that samples of milk taken in the usual way from the large vessels in which it is kept and conveyed for sale, hardly can, and generally does not, fairly represent an average of the bulk from which they are taken in regard to the proportion of fat present.—I am, &c.,

T. Redwood.

17, Bloomsbury-square,
December 29, 1875

ESTIMATION OF MINUTE TRACES OF COPPER.

To the Editor of the Chemical News.

Sir,—Will you allow me to draw attention to the fact that a process for the estimation of minute traces of copper, after precipitation of iron with ammonia, exactly similar to that given by Mr. Carnelley in your issue of this week (vol. xxxii., p. 308), was proposed by me in the Chemical News, vol. xxxii., p. 3, in an article on the analysis of minium, of which an abstract appears in the *Journal of the Chemical Society* for December last. It is fair to own that the principle was suggested by Mr. Carnelley's process for the estimation of iron, and I frankly confess that, with the splendid opportunities of experiment and investigation offered by the laboratory of Owens College, he has treated the subject with a thoroughness and precision which were unattainable by me, owing partly to want of leisure, and partly to the fact that the method was improvised under pressure of the sudden necessity for giving a complete analysis of a series of remarkably pure samples of red lead. He will find, however, on referring to my paper, that I have drawn attention to the disturbing influence of ammoniacal salts, which I have proposed to neutralise by the preparation of a comparison liquid from one-half of the solution to be examined.

It would appear that the usefulness of colorimetry, and also of judgment by turbidity, which may be provisionally termed "nephelometry," might be widely extended by the elaboration of a thoroughly reliable process for determining the exact equivalence of columns of liquid of different lengths by the correspondence of their colour or appearance as viewed from the ends; such devices as the preparation of comparison liquids, or the intentional addition of foreign salts, might then be entirely dispensed with as follows:—

Let two equal columns of the solution to be tested be taken, and let their exact measure be known; then let a different proportion of a standard solution of the ingredient to be determined be added to each—it will probably be convenient to add twice as much to one as to the other—and let the columns be made equivalent by shortening one of them. It will be evident that if the original solution was quite free from the substance sought, the comparative lengths of the columns will correspond with the proportions of standard solution added to each, or in the case supposed will be represented by the fraction $\frac{n}{2n} = \frac{1}{2}$; but, if the original solution did contain the substance to be determined, the value of the fraction will be altered, and the quantity present in the longer column, the bulk of which is known, may be determined by a simple equation.

Let $\frac{a}{b}$ be the fraction representing the comparative lengths of the columns, then the quantity of the substance in the longer one may be determined by the equation—

$$\frac{a\,(x + 2n)}{b} = x + n$$

where n, of course, represents the known quantity o ingredient added to the longer column by means of the standard solution.

The application of this principle may be rendered clearer by an example.

The difficulty of obtaining distilled water absolutely free from ammonia for use in Wanklyn's process of water analysis is well known, and it would be obviously very convenient to determine once for all the proportion of ammonia in a given sample; we might proceed thus: two columns measuring four ounces each are taken; to one of them is added standard ammonia solution equal to 0·0005 grain, to the other equal to 0·001 grain ammonia, the column of stronger tint is shortened, after Nesslerising, until the colour, viewed from above or below, by means of an appropriate apparatus, exactly corresponds; if the distilled water was pure one column will be exactly one-half the length of the other, if ammonia was present the fraction will be greater. Suppose it is $\frac{9}{14}$, then—

$$\frac{9\,(x + 0{\cdot}0001)}{14} = x + 0{\cdot}0005$$

which will give $x = 0{\cdot}0004$ grain.

The "appropriate apparatus" mentioned above is, so far as I am aware, still a thing of the future.—I am, &c.,

Thos. P. Blunt, M.A. Oxon., F.C.S.

Shrewsbury, January 1, 1876.

COPPER IN BREAD.

To the Editor of the Chemical News.

Sir,—Dr. Edmunds in his contribution to the Chemical News of December 31 (vol. xxxii., p. 311), throws doubt

on the fact that copper has ever been used as an adulterant for bread, and suggests that the blue colour developed on charring bread ashes to a red heat may have given rise to the idea. I have myself found copper in the years now in Belgian bread by the wet process (though never in English), but believe that that adulteration no longer is continued at the present day. I cannot imagine how Dr. Edmunds can suppose that a *chemist* could mistake a *blue* colouration at a *bright red heat* to be due to the presence of copper.—I am, &c.,

ROWLAND J. AITCHERLEY.

January 1, 1876.

SODA TESTS.

To the Editor of the Chemical News.

SIR,—Amongst the points in connection with the commercial analysis of soda-ash, which have not been touched upon by your correspondents, there is one of some importance, namely, that of filtering the solutions before testing.

It is evident that any matter, insoluble in boiling water, which neutralises test acid, causes the ash to appear by so much of more value than it really is to the consumer.

The following cases, not selected, but being simply the last three parcels of ash we have used, show what this may probably amount to in good ashes. The alkali in the well washed residue is reckoned at its equivalent of Na_2O ($Na = 23$).

	Na_2O in solution.	Na_2O in residue.	Total.	Teschemacher's certificate.
I.	53·82	0·40	54·22	54·40
II.	53·57	0·43	54·00	54·20
III.	50·18	0·93	51·11	51·20

The slight difference between Messrs. Teschemacher and Smith's analyses and my own is no doubt very easy of explanation.

Now as the ash is charged at so much the unit according to the percentage of soda, and in III. we have 0·93 useless, out of 51·11 there is a loss to the consumer of over 1¾ per cent. of the money value; or, if we compare the make of I. and II. with III., as there is a difference of 0·5 out of about 50, there is a loss of 1 per cent. on buying III. as compared with the others.—I am, &c.,

SAMUEL HALL.

East London Soap Works, Bow.
December 27, 1875.

SODA TESTS.

To the Editor of the Chemical News.

SIR,—It must strike any disinterested person who has perused your correspondence on the subject of commercial alkali testing, that the reputation of the analysts referred to is somewhat under a cloud, and that it is incumbent upon them as they value their commercial integrity to offer some reason for the discrepancies which have been laid to their charge.

It is no secret that for many years the "Liverpool test" has been regarded by all but those more immediately benefitted by it, as thoroughly anomalous; and now that the subject has been ventilated in your columns, if no explanation be forthcoming, there would seem to be no alternative but to suppose that it does not pay to expose its fallacies.

The tests must either be right or wrong. If the upholders of it believe the former, why do they not furnish grounds for their belief? If the latter, why do they not explain that it is simply a case of "trade custom," with which they do not consider it their business to interfere?

Some time ago I acted as manager of a Lancashire works, and had occasion to make many tests of soda-ash and caustic soda. And I need not add my results seldom or never corresponded with the Liverpool test of the same samples. The analysts with whom I had to deal professed, I believe, to standarise their test acid on the 24 equivalent system; but, even adopting the same equivalent, I had to make it a rule to add 1 per cent to my results. The consequence was that I quickly found it to be quite unnecessary to send out 70 per cent caustic soda higher than 69 per cent, or 55 per cent soda-ash over 54 per cent of my test, feeling sure that it would turn up all right in Liverpool.

It is unpleasant to seem to impugn the commercial honesty of members of a profession which, of all others, appeals directly to the conscience, but neither is it agreeable to know that the possibility exists of purchasing ash by London, Glasgow, or Newcastle test and selling it at a profit by the Liverpool one.

Not merely, however, is the testing objectionable, the sampling is extremely lax. It used to be no uncommon thing to sample parcels of fifty to a hundred casks or drums by merely drawing small portions from two or perhaps three at most. I have in fact known cases where, from the sampler being in a hurry to catch a train, he has been content with sampling a single one.

So unsatisfactory indeed are both the sampling and analyses, that it is usual for manufacturers, when the first sampling and test does not accord with their expectations, to order a second or even a third sampling, till the test comes out of the required strength. I have an instance in my mind of a batch of some fifty casks of ash being sampled three successive times by the Liverpool chemist, and certified successively as 53 per cent, 52 per cent, and 54 per cent alkali; the latter being the strength at which the manufacturer had invoiced the parcel previously to its being despatched from the works. It is my impression that many of the brokers do not discourage this state of affairs, and that in numerous instances, so long as a certificate of some sort is forthcoming to send out to America with the invoice, they do not care whether it represents the true strength or not.

But as many thousands of tons of alkali are annually shipped from Liverpool, and sold entirely on the Liverpool test, how important the matter is will at once appear. And it is therefore devoutly to be hoped that the present state of affairs may speedily have an end.—I am, &c.,

JOHN MORRISON.

Pottery Lane, North Bank, Newcastle-on-Tyne
December 29, 1875.

LIVERPOOL SODA TESTS.

To the Editor of the Chemical News.

SIR,—I have read in the CHEMICAL NEWS the address of Mr. John Pattinson to the Tyne Chemical Society, in which he makes some remarks respecting Liverpool soda tests. I have also read the correspondence on the same subject published in your paper.

As one Liverpool chemist, engaged to a considerable extent in the examination of alkali products, I must emphatically deny that my test differs materially from what Mr. Pattinson terms the "Tyne test," or that it ranges higher than the ordinary commercial test, which is, as Mr. Pattinson states, "based on the assumption of the old chemists that pure carbonate of soda contains 59¼ per cent of soda" (the old equivalent of soda being taken as 32 and that of carbonate of soda 54).

Some seven years ago I had a long correspondence with Mr. Pattinson respecting soda tests, when the subject was fully and fairly discussed between us. As a result of this correspondence, and of numerous discussions with other persons familiar with the origin and working of the commercial soda assay, I then arranged a method of working, which I have ever since employed, and which translates the percentage of soda ascertained on the basis of the equivalent more generally accepted by modern chemists (carbonate of soda 53 containing soda 31) into the commercial standard, in such a way as to obtain

figures that are essentially the same as those given by Mr. Pattinson himself in his paper published in the CHEMICAL NEWS of March 5th, 1869.

The practice of reporting the commercial assay in whole degrees, here adopted and thoroughly understood, and which I follow, may sometimes make my report *half a per cent higher* than Mr. Pattinson's, and at other times *half a per cent less*, but this is the very outside difference, and in actual practice it is rarely so wide a difference can occur. This practice, which I am informed is not confined to Liverpool, is, as I view it, the interpretation of results, obtained on chemical data, and by chemical methods to meet a well-known and well-understood trade custom. All soda-ash and caustic soda rules are here based on whole degrees only. Any portion of a degree below a half is not paid for, but above a half is paid for as a whole number.

Whilst working by the method I have alluded to, and testing for some of the oldest and largest firms in the alkali trade, buyers as well as sellers, and my reports sent not only to numerous places in the United Kingdom, but to very many places abroad, I can safely say that for fully six years past I have not received one single intimation that my reports have been *too high*, but I have had occasional complaints that my results were *too low*, and in one or two cases business has been withdrawn from me on the distinct statement that such was the case.

I should be sorry, sir, to make such an apparently egotistical statement did I not feel that as a "Liverpool chemist" I am included in the remarks of Mr. Pattinson, and therefore called upon to defend myself from the imputation, which apparently includes *all* Liverpool chemists who test alkali products of reporting higher figures than are warranted by following the "ordinary commercial standard."

Mr. Pattinson mentions a case in which a sample of caustic soda, tested in Liverpool, was certified by a Liverpool chemist to contain 60 per cent of alkali. The "*identical sample*," he says, tested in his laboratory was found to contain only 57 per cent. He adds that "no notice was taken by the Liverpool chemist of the request to the buyer that the sample should be re-examined." Inasmuch as I make it an invariable practice, although using every precaution to ensure accuracy in my work, to fully consider any objection that may be raised to my analyses and assays, and fully sift all possible sources of error, I am able to say that the case referred to by Mr. Pattinson has not been brought to my notice. I therefore, without hesitation, disclaim any connection with the transaction. But just a word or two in reference to it. It would be interesting to know whether or not it was a sample of "cream" caustic soda, and, if so, whether it was the very same identical bottle sample, or a sample drawn from the identical *bulk*. I can well understand a considerable difference in samples of cream caustic soda drawn from the same bulk, although I will not go so far as to say the difference would extend to three per cent. Different strengths of cream caustic soda may be drawn *from the same drum*. It is an alkali product that should be sampled with extreme care, in order to arrive at the average strength of the bulk.

And this leads me to remark that one of the most constant sources of disagreement in the reports of different chemists lies in the sampling operation. The drawing of samples is a most important matter, requiring the most scrupulous care, whereas it is very frequently conducted in a most careless and incomplete manner, and then differences in tests must result. To compare the results of different chemists, tests of portion of the very same sample must be insisted on.

A further source of difference lies in difference of manipulation, but on this point I would say that having tested alkali products, either in alkali manufactories, or as a professional analyst, for nearly twenty years, I cannot state any reason for the wide differences referred to by Mr. Pattinson, provided that ordinary care is taken in the manipulation. Some slight differences will occur, even with the most careful analysts, but provided the manipulation does not infringe any chemical principles, or allow of wide discrepancies in consequence of the introduction of inconvenient and complicate details, the testing of soda-ash is, as Mr. Pattinson says, "so simple an operation that there need be no difficulty in two chemists agreeing within a quarter per cent." I would add, *the samples being identical*.

With regard to the letter of Mr. George Warner, F.C.S., I can say that I believe he will not object to my stating that I have several times exchanged samples with him, and that our results have closely agreed.

One word in conclusion. It is undoubtedly inconvenient that the commercial standard differs from the chemical standard now generally accepted by chemists, but manufacturers and buyers based their trade custom on the statements of the older chemists, and it is inconvenient to be continually changing a trade standard. Still, the difference between the chemical and the trade standard being known, it is possible that sales based on the chemical standard may gradually be made until that standard only is adopted. But in this case buyers must expect to pay a corresponding increase in price. I very often make tests based only on the 31 equivalent of soda for sellers and buyers who distinctly understand on what basis they are working, and I believe that such tests are satisfactory to both parties as well as to myself.

Apologising for the length of my communication, I am, &c.,

A. NORMAN TATE.

7 and 9, Hacking Hey, Liverpool.
December 30, 1875.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences. No. 23, December 6, 1875.

Constitution of the Phosphates.—MM. Berthelot and Louguinine.—In this memoir the authors examine the formation of an insoluble phosphate, that of baryta; they undertake an alkalimetrical study of phosphoric acid; and, finally, they seek to define the displacements and reciprocal distribution of an alkaline base among phosphoric acid and the nitric, hydrochloric, and acetic acids. They conclude that phosphoric acid is not a tribasic acid of the same kind as citric acid, as the third equivalent of a soluble base is separated from phosphoric acid by the feeblest actions, and even by dilution. With ammonia it happens that this third basic equivalent does not combine with phosphoric acid, or if it combines at first it does not remain definitely united to the acid, but is gradually separated spontaneously and completely. Neither is phosphoric acid a bibasic acid in the same sense as are the sulphuric, oxalic, or tartaric acids. The second base, as alkalimetrical operations show, is not neutralised by phosphoric acid, and is entirely separated by the hydrochloric and nitric acids, and gives indications of division even with acetic acid. In short, the three equivalents of base united in the phosphates considered as normal are combined in different and unequal manners. Phosphoric acid must be regarded as a monobasic acid of a mixed function.

Colouring Matter of the Fruits of Mahonia, and the Characters of the Wine which may be obtained from them by Fermentation.—I. Pierre.—Upon cotton the juice of this fruit gives fugitive red stains, which with ammonia give a variety of unstable greens. The wine

obtained from the berries is admitted to have a disagreeable flavour, but the author suggests that it might be used for giving a factitious colour to inferior wines.

Note on a Process of Magnetisation called Double Touch.—M. J. M. Gaugain.—Not adapted for abstraction.

Temperature of Elevated Regions of the Atmosphere.—M. D. Mendelef.—It appears that in the upper strata of the atmosphere there exists a source of heat, for the observed heat is always higher than the calculated temperature. This source of heat is doubtless found in the aqueous vapours of the atmosphere.

Transparence of Flames and of the Atmosphere, and on the Visibility of Scintillating Fires.—M. E. Allard.—The nature of this paper appears sufficiently from the title.

Distribution of Magnetism in Circular or Elliptical Discs of Steel.—M. E. Duter.—The author's results are that the sum total of magnetism diffused over circles or ellipses is proportional to the surface. This magnetism may be considered as distributed on threads which affect a hyperbolic form. The non-transverse axes of these hyperboles are the axes of symmetry of magnets perpendicular to the neutral line.

Certain Properties of Gallium.—M. Lecoq de Boisbaudran.—Already inserted in full.

Hydrated Derivative of Cellulose.—M. Aimé Girard.—The compound examined by the author consists of—

Carbon	42·1
Hydrogen	6·4
Oxygen	51·5

The equivalent of water fixed in this substance resists desiccation. The substance, for which the author proposes the name hydro-cellulose, is characterised by its extreme friability.

Constitution of the Albumenoids.—M. P. Schützenberger.—The author finds that the differences of constitution of the proteic matters are of the second order, and that they all contain a common nucleus, around which are grouped variable proportions of less important groups, such as urea, oxamid, tyrosin, and the glutamic acid of gluten.

Bulletin de la Société Chimique de Paris.
No. 11, December 5, 1875.

Reply to the Objections of M. A. Gautier, relative to the Part played by Carbonic Acid in the Spontaneous Coagulation of Blood.—M. E. Mathieu and V. Urbain.—The authors maintain that carbonic acid is the cause of the spontaneous coagulation of blood, and during life the fibrin dissolved in the plasma does not coagulate, because the acid gas, in the same manner as oxygen, is combined with the red globules.

Constitution of Benzin.—MM. A. Rilliet and E. Ador.—A hypothetical paper, not adapted for abstraction.

Extraction of Sulphur.—C. F. Sestini.—Having observed, in the Romagna, a workman carefully picking out crystals of gypsum mixed with sulphur ore, before its introduction into the *doppione* (a furnace receiving a double row of retorts), he was told that in the furnace gypsum destroyed the sulphur. On investigating the reactions ensuing when gypsum and sulphur are heated together, he found that at 130° the gypsum lost all its water and became anhydrous. At higher temperatures, up to 444°, the sulphur reduced the sulphate of lime to a sulphide, and escaped as sulphurous acid :—

$$CaSO_4 + 2S = 2SO_2 + CaS.$$

Does the Mould developed on Organic Bodies assimilate the Nitrogen of the Atmosphere ?—MM. F. Sestini and J. del Torre.—The authors having reviewed the conclusions of Boussingault, Boischode, Selmi, and others, and having repeated their experiments under varied conditions, express the opinion that the slight increase of nitrogen found after the growth of *Penicillium* was due rather to the absorption of atmospheric ammonia than the direct assimilation of free nitrogen.

The Jaborandi (*Polycarpus pinnatus*).—M. E. Hardy.—The essential oil of the *Polycarpus*, as regards its boiling-point and certain of its characters, resembles the iso-terebenthenes, and is exceedingly analogous to the oil of citron.

Solution of Platinum by Sulphuric Acid in the Process of Concentration.—M. A. Scheurer-Kestner.—Already noticed.

Nitronaphthyl-Sulphurous Acids and their Derivatives.—M. P. T. Cleve.—The author's object was to examine the acid which Laurent obtained by the action of fuming sulphuric acid upon nitro-naphthalin, to compare it with those obtained by the action of nitric acid upon α and β naphthyl-monosulphurous acids, to compare these acids, and to transform them into the corresponding di-oxynaphthalines and dicarbonated acids.

Bisulphate of Lithia.—M. H. Lescœur.—This salt is obtained by the use of monohydrated sulphuric acid. It forms deliquescent crystals, which when dried consist of $LiOSO_3$ 51·87 per cent, free sulphuric acid 46·85 per cent. Theory requires sulphate of lithia 52·88 per cent, to 47·12 per cent of sulphuric acid. Its melting-point is about 120°.

Biacetate of Thallium.—M. H. Lescœur.—This s is obtained by exposing a solution of acetate of thallium in monohydrated acetic acid to spontaneous evaporation. Its formula is $TlO,C_4H_3O_3,C_4H_4O_4$. It contains 64·82 per cent of thallic oxide, and 18·84 per cent of free acid. The salt effloresces slightly in dry air, and melts at about 64°.

Biacetate of Lithia.—M. H. Lescœur.—The solution of neutral acetate of lithia in glacial acetic acid deposits, on spontaneous evaporation, crystals in the form of a hopper. Its formula is $LiO,C_4H_3O_3,C_4H_4O_4$, and it contains 11·54 per cent of lithia, and 49·05 of acetic acid. It is deliquescent, and melts at 99°. If heated suddenly in a small platinum capsule it gives off vapours of monohydrated acetic acid, which take fire and burn.

Part played by Carbonic Acid in the Phenomenon of Coagulation.—Dr. F. Glenard.—The author infers, from the experiment described, that carbonic acid plays no part in the coagulation of blood.

Transformation of Starch by the Action of Diastase, and the Production of a New Saccharine Matter.—M. A. Petit.—If at a constant temperature of 50° a gramme of diastase is allowed to act for some hours upon a kilo. of starch paste at 1·10, the liquid, after filtration and prolonged ebullition,—in order to stop the action of the diastase,—contains, besides maltose capable of fermentation and of reducing Fehling's liquid, another fermentable sugar, without action upon Fehling's test, even after ebullition for five minutes in contact with sulphuric acid at 1·100.

New Alcoholometric Formula.—M. C. Delavaud.—Not adapted for abstraction.

Correspondence from St. Petersburg Nov. 10th, Session of the Chemical Society Sept. 11 to 13.—The minutes of the Session contain a very interesting pape by M. N. Zalomanoff, on the absorptive power of soils M. Beilstein announces that in the action of a mixture of hydrochloric acid and chlorate of potassa upon benzoic acid there is formed, besides, β-dichlorobenzoic acid and the ordinary α-dichlorobenzoic acid. M. Menschoutkine, on behalf of M. Lissenko, handed in a note on the memoir of M. Jatzoukowith on the action of oxygen on coals and paraffins. M. Menschoutkine also announced, on behalf of MM. Tscheque and Steiner, that the action of monochloracetic ether upon xanthogenate of potash gives rise to xanthogenacetic ether.

The same issue c s a memoir, by M. Beilstein, on the dichlorobenzoic cids.

THE CHEMICAL NEWS.

VOL. XXXII. No. 842.

ON THE

ESTIMATION OF VERY SMALL QUANTITIES OF LEAD AND COPPER.*

By M. M. PATTISON MUIR, F.R.S.E.,
Assistant Lecturer on Chemistry, Owens College.

As I have lately been occupied with experiments upon the action of saline solutions upon lead and copper, which involved the measurement of very small quantities of these metals, I thought it might be well to test the accuracy and delicacy of the method employed.

The method itself is in no way new, being that described by Wanklyn in his book on "Water Analysis." The depth of colour produced by the addition of sulphuretted hydrogen water to a known volume of the liquid under examination is compared with the colour produced, by the same means, in an equal volume of water, to which a known amount of lead or copper, in solution, has been added. In comparing the colour of the liquid under examination with the standard liquid, I find it preferable to employ stout glass tubes, holding about 100 c.c., and having a diameter of about 1·5 c.m., rather than white porcelain dishes as recommended by Wanklyn. The contents of the tubes are thoroughly mixed by means of glass tubes on the ends of which bulbs have been blown. (See Thorpe, "On a Method of Estimating Nitric Acid, &c." *Journ. Chem. Soc.* [2], xi., 547.)

Wanklyn recommends the use of standard solutions, 1 c.c. of which is equal to 1 m.grm. of copper or of lead: he employs 70 c.c. of the water to be tested. If, therefore, the colour produced on adding sulphuretted hydrogen water to 70 c.c. of the liquid under examination is found to be equal to that produced by the addition of the same reagent to 70 c.c. of distilled water to which 1 c.c. of the standard has been added, we shall have 1 grain per gallon of lead in the water. But 1-10th of a grain of lead per gallon is generally considered hurtful when present in a drinking water; to estimate this we should require to use only 0·1 c.c. of the standard: a very small error in reading the burette measurements would introduce a comparatively large error in the result. Thus, in the case of a water containing 1-10th grain of lead per gallon, an error in reading of 0·05 c.c. would introduce an error in the quantity of lead equal to one-half of the total quantity to be estimated. The first point, therefore, to investigate appeared to be *the strength of the standard solutions*. I shall describe the experiments made with copper.

Standard used, 1 c.c. = 1 m.grm. copper.

Expt.	Taken.	Found.
No. 1 ..	5·0 m.grms. per litre	4 m.grms. per litre.
,, 2 ..	2·5 ,, ,,	2 ,, ,,

Standard used, 1 c.c. = 0·1 m.grm. copper.

Expt.	Taken.	Found.
No. 3 ..	5·0 m.grms. per litre	4·8 m.grms. per litre.
,, 4 ..	2·5 ,, ,,	2·4 ,, ,,
,, 5 ..	0·5 ,, ,,	0·5 ,, ,,

In each case 50 c.c. of liquid was used.

Similar results were obtained with lead solutions.

The use of a standard, 1 *c.c. of which is equal to 0·1 m.grm.* of copper or of lead enables more accurate and more delicate results to be obtained than the use of a stronger standard does.

The second point to be determined was *the limits of accuracy of the method*, and first as to the lower limit.

From the experiments with copper already detailed it will be seen that 0·5 m.grm. of copper per litre could be estimated by using 50 c.c. of the liquid.

Standard used, 1 c.c. = 0·1 m.grm. copper.

Solution contained 0·25 m.grm. of copper per litre. Details as before.

Added 0·3 c.c. standard. Colour too dark.
,, 0·2 c.c. ,, ,, rather too dark.
,, 0·1 c.c. ,, ,, equal to the other.

Expt.	Taken.	Found.
No. 6 ..	0·25 m.grm. per litre	0·20 m.grm. per litre.

In this experiment it was very difficult to determine the exact point at which the colours were the same, as the intensity of colouration produced was very slight. A further addition of 0·05 c.c. of the standard could hardly be said to produce a noticeable change in the depth of colour.

I think, therefore, that 0·5 m.grm. of copper per litre = 0·035 grain per gallon, is the smallest quantity which can be accurately estimated by this process when working with 50 c.c. of the liquid under examination.

The amount of lead which can be estimated with accuracy is less minute than the amount of copper.

Standard used, 1 c.c. = 0·1 m.grm. lead.

Expt.	Taken.	Found.
No. 7 ..	0·25 m.grm. per litre	No colouration.
,, 8 ..	0·50 ,, ,,	0·4 m.grm. per litre.
,, 9 ..	0·75 ,, ,,	0·6 ,, ,,
,, 10 ..	1·00 ,, ,,	1·0 ,, ,,

1 m.grm. of lead per litre = 0·07 grain per gallon, is, therefore, the smallest quantity which can be accurately estimated by this process when working with 50 c.c. of the liquid under examination.

By the evaporation of 1 litre of water to 50 c.c., a quantity of copper so small as 0·025 m.grm. per litre, or of lead equal to 0·05 m.grm. per litre, can be estimated by this process. In other words, the process will estimate 1 part of copper in in 2,000,000 parts of water, or 1 part of lead in 1,000,000 parts of water.

Secondly, as to the upper limit.

Standard used, 1 c.c. = 0·1 m.grm. copper.

Expt.	Taken.	Found.
No. 11 ..	20 m.grms. per litre	20·4 m.grms. per litre.
,, 12 ..	10 ,, ,,	10·0 ,, ,,
,, 13 ..	25 ,, ,,	24 to 28 ,, ,,
,, 14 ..	30 ,, ,,	28 to 32 ,, ,,

20 m.grms. of copper per litre = 1·4 grains per gallon is the largest quantity which can be estimated by this method when working with 50 c.c. of the liquid under examination.

With lead the following results were obtained:—

Expt.	Taken.	Found.
No. 15 ..	10 m.grms. per litre	10 m.grms. per litre.
,, 16 ..	12 ,, ,,	12 to 15 m.grms. p. lit.
,, 17 ..	15 ,, ,,	Colour too dark to allow of estimation.

10 m.grms. of lead = 0·7 grain per gallon is therefore the largest quantity which can be estimated by this method when working with 50 c.c. of liquid.

In making these determinations I found that the colours of the liquids might be compared *immediately* after the addition of sulphuretted hydrogen. The colours did not become intensified on standing.

* A Paper read before the Manchester Literary and Philosophical Society.

I also found that it was immaterial whether the standard was added before the sulphuretted hydrogen water or *vice versa*. Thus there is no need, if the colour of the standard be too light, to prepare a fresh standard, as must be done in Nesslerising. It is only necessary to add another measured quantity to the liquid which already contains sulphuretted hydrogen.

The addition of one or two drops of dilute hydrochloric or nitric acid in no way affected the accuracy or delicacy of the estimation of copper. In the case of lead, a drop of hydrochloric acid caused a faint turbidity (especially in estimating large quantities of the metal), which interfered materially with the results. If an acid must be added, acetic acid is, I think, the best.

When working with 50 c.c. of liquid, so small a quantity as 0·5 m.grm. of copper, or 1 m.grm. of lead per litre, may be estimated by this process. If it is required to estimate smaller quantities than these, the liquid must be concentrated by evaporation. If the amount of copper exceed 20 m.grms., or of lead exceed 10 m.grms. per litre, a smaller quantity of the liquid than 50 c.c. must be used.

ON SOME RECENT DISCOVERIES OF FIELDS OF IRON ORE IN THE SOUTH OF RUSSIA.

By SERGIUS KERN, St. Petersburg.

These new fields of beautiful iron ore are situated partly in the Verchni-Dnieprovsky district of the Ekaterinoslaw Government, partly in the Elizavetgradsky district of the Cherson Government; iron ore is found here on the rivers Saksagane and Ingouletz, near the village Krivoy-Rog. About twelve miles from this place on the river Saksagane, near the village Tchervonnaia-Balka, large quantities of red hematite are found. Immense layers of hematite, 100 feet thick, are situated near the river Ingouletz and the village Doubovaia-Balka. The best layers of iron ore are the following:—

1. On the left side of Ingouletz and on the right of Saksagane between the villages Krivoy-Rog and Doubovaia-Balka is a layer of ironstone 120 feet thick; the results of the analyses are:—

	Per cent.
Oxide of iron	68·40
Manganese	0·50
Silica	22·10
Alumina	3·00
Lost from ignition	6·00
	100·00

2. On the left side of the river Saksagane a layer of red hematite 42 feet thick; gives 62·5 per cent of oxide of iron.

3. On the same river Saksagane exist layers of magnetic iron ore and of brown hematite; a sample of the latter analysed gave the following average composition:—

	Per cent.
Oxide of iron	73·40
Manganese	1·30
Silica	18·03
Alumina	2·25
Lost from ignition	5·02
	100·00

It is estimated that the new fields of iron ores contain altogether 90,000,000 tons of ore. There is a railway going to be constructed to these mines, and some blast-furnaces are to be erected.

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 3.)

Perhaps Mr. E. H. Thiellay has unintentionally become the founder of a manufacture of peroxide of hydrogen which may have worthier applications in the future. Perhaps he may not be the first or the only hair-bleacher, as appears from the following document. What von Schrötter revealed to the public was previously known to the initiated. Thus it appears from a letter of M. Schering, of the Council of Commerce, dated Berlin, July 3, 1874, in which occurs the following passage:—

"The bleaching of hair, feathers, &c., by means of peroxide of hydrogen has been found practicable, the greatest difficulty being the ready decomposability of the material. In England and France it is prepared and sold for this purpose in quantity under the names 'Golden Hair Water' and 'Auricome.' In my establishment it is often enquired after for the same purpose." Mr. J. Williams, of the firm Hopkin and Williams, of London, makes a similar statement in letters of July 20 and 27, 1874. By peculiar precautions, however, he is able to prepare permanent solutions of peroxide of hydrogen containing 10 to 20 volumes of available oxygen (3 to 6 per cent by weight of H_2O_2). The weaker solution, which is said to keep for months without change, is sold at 8s. per kilo., in larger quantities at 6s. The stronger solution is sold at double the price. The amount of oxygen in Thiellay's solution, as determined in the Berlin laboratory, agrees tolerably closely with the weaker of these preparations, and this may possibly be its true origin. As the bottle when the determination was made had been opened four weeks previously; as it was only half full and was merely provided with a common cork, the permanence of the solution may be considered sufficient for most purposes.

Peroxide of hydrogen would not be the first body whose industrial application commenced with trifles and gradually reached an unimagined extension. Nitrate of silver served first the vanity of the world as a hair-dye long before its applications in photography. Schrötter† very rightly expresses the wish that peroxide of hydrogen might be generally accessible at a moderate price. Böttger,‡ and previously Geiger,§ recommend its introduction into the pharmacopœia. That for medicinal purposes it is preferable to oxygen, ozone, or ozone-water (!) is manifest. Whilst ozone only bleaches ivory in the strongest sunshine of summer, there is no doubt but that peroxide of hydrogen would answer the same purpose even in the absence of light.

Progress in the Artificial Production of Cold and Ice. By Dr. H. Meidinger, Professor in Carlsruhe.

Concentrated cold in the form of ice acquires day by day a higher importance for industrial as well as for domestic purposes. Brewing on the Bavarian system, the preparation of "Lager-beer," which, amongst us in Germany at least, has nearly superseded all other kinds of beer, depends upon the prolonged maintenance of a temperature bordering upon freezing-point. The confectioner has no other practical means of producing a degree of cold from $-12°$ to $-18°$, as required in the preparation of ice-creams. The physician often employs the cold of

* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzehends."

† Von Schrötter, see above.

‡ Böttger, *Polytech. Notizblatt*, 1875, 15.

§ Geiger, *Lehrbuch der Pharmacie* 4th. bearb., v. Liebig, i., 213.

ice both externally and internally as an absolutely indispensable remedy. The butcher and the hotel-keeper can scarcely dispense with this means of preserving meat. In the domestic sphere ice has become formally established, at least in large cities, where it can always be obtained at a cheap rate, and to those who have become accustomed to its use it appears a necessary agent for preserving food and cooling beverages during the warm season. In chemical manufactures ice has also found various applications in the crystallisation of salts, or, to speak in more general terms, in the separation of dissolved substances by means of cold. In proportion to the growing consumption we see increasing quantities of ice stored up every winter. An extensive system of transportation has been arranged for conveying ice from the more northern and colder parts of the earth to regions nearer the equator. North America especially ships ice in astonishing quantities in all directions, even to Central and South America, to the West Indies, and to India. Ice from Norway is sent to England and the German ports on the North Sea. In mild seasons, such as 1862-63 and 1872-73, ice from the glaciers of the Alps was sent down the Rhine in entire trains.

Science has shown, however, how to prepare this important requisite artificially. The first attempts at the manufacture of ice on the large scale took place between 1850-60; but this branch of industry has since been much extended. Even in regions where the winter is, as a rule, cold enough to permit ice to be stored up in quantity, *e.g.*, in Germany, it has often been found remunerative to construct machinery for its artificial preparation, or, in general terms, for the production of cold. Manufacturing establishments of this kind may be seen in various places in full activity, and after the mild winter of 1872-73 the demand for machine-made ice could scarcely be met.

The London Exhibition of 1862 introduced the ether and ammonia ice machines. A third system has since been added, the air ice machine, which has not yet reached perfection, since peculiar difficulties interfere with its practical execution. The theories of these machines have been already explained, so that there is no difference of opinion as to their capabilities and their relative merits. A series of proposals have also been made for the production of cold by other agencies, which have hitherto produced little or no practical result. We will endeavour to descsibe the development which the question has taken in all its branches down to the present day.

(To be continued.)

THE ROYAL SOCIETY.
AWARD OF MEDALS TO DR. HOFMANN AND MR. CROOKES.

In presenting the Copley Medal to Dr. Hofmann and a Royal Medal to Mr. Crookes at the Anniversary Meeting of the Royal Society, November 30, 1875, Dr. Hooker, the President, said:—

"The Copley Medal has been awarded to Professor August Wilhelm Hofmann, F.R.S., of Berlin, for his numerous contributions to the science of chemistry, and especially for his Researches on the Derivatives of Ammonia.

"The researches of Dr. A. W. Hofmann, from first to last, are related by a strict logical connection, from which (although in various side-paths he has made truly interesting discoveries) he has never essentially deviated. Indeed these researches may be considered as constituting one great and prolonged research on the organic bases theoretically and experimentally considered. It is not, however, to be imagined that because, to a certain extent, limited in its range, this work is of a special or technical order. The subject covers a large area, and is calculated to lead the investigator to the consideration of the most important chemical problems.

"The memoirs of Dr. Hofmann in reference to the organic bases fall under several heads:—(1) The researches on Aniline and the Organic Bases contained in Coal-tar. These researches are mainly included in the period between 1843 and 1850. (2) The investigations on the molecular constitution of the organic bases derived by the substitution of the Alcohol radicals in the molecule of Ammonia (1850-51). (3) The Phosphorus Bases and the Diatomic Ammonias (1857-60). (4) The investigations on Rosaniline and the various Colouring-matters derived from Coal-tar (1860-70).

"In the course of the aniline investigations Hofmann made an important contribution to the unitary theory of chemistry. Dumas had shown that the essential chemical properties of acetic acid were not altered by the substitution in the acid-molecule of chlorine for hydrogen; but no organic base had yet been discovered derived from another base by a similar process. Fritsche, indeed, had made a bromine derivation of aniline, in which three atoms of hydrogen were replaced by bromine; but the substance thus formed was a neutral (not basic) body. It occurred to Hofmann that the substitution had here gone too far, and that for this reason the basic properties of aniline had disappeared. Consequently, by an ingenious process (devised for the experiment), the treatment of chlorisatin by the hydrate of potash, he prepared mono-chlor-aniline—aniline, that is, in which one atom of hydrogen was replaced by chlorine. This body was a base, like aniline itself. Hofmann established its basic character by the preparation of many of its salts (*Liebig's Annalen*, vol. liii., p. 1, 1845).

"At the date when Hofmann's paper on the molecular constitution of the volatile organic bases was presented to the Royal Society (December, 1849), Wurtz had just prepared, by a striking experiment, the primary monamines of the alcohol radicals—that is, a system of bases in which one-third of the hydrogen of the ammonia was replaced by the hydrocarbon, the existence of which (it may be noticed) had been predicted by Liebig as a consequence of his views as to the composition of the organic bases. The experiments of Hofmann were in the same direction as those of Wurtz, but of far more general application. By the action of the iodides of the alcohol radicals upon ammonia, Hofmann replaced successively the three atoms of hydrogen which its molecule contains by these hydrocarbons—a method fraught with important results, both theoretical and practical, with which all chemists are familiar.

"Among other consequences, this method placed the theory of types on a solid experimental foundation, which served as the basis of its future development. A critical test was given by which the constitution of any given "ammonia" could be ascertained, the number of derivatives of the "ammonia" when subjected to the action of iodide of ethyl corresponding to the number of atoms of hydrogen which it still retained unreplaced by hydrocarbon. Hofmann applied this test to aniline, and demonstrated, by the successive formation of ethyl-aniline and diethyl-aniline, that this base belonged to the primary monamine class, containing two atoms of hydrogen unreplaced by hydrocarbon. To trace out, however slightly, the consequences of this method would be a serious task indeed. It is sufficient to say that the views at present held by chemists as to the molecular constitution of water, according to which water is regarded, like ammonia, as a typical molecule, but containing two atoms of hydrogen (instead of, as in the other case, three) replaceable by the alcohol radicals, are based upon experimental evidence for which the very same instrument of research, the iodide of ethyl, and methods in all respects analogous to those by which Hofmann thus established the constitution of aniline were employed.

According to these views triethyl-aniline represented

ammonia in which all possible substitutions of this order had been effected. However, Hofmann applied his test to this substance, and obtained a most remarkable result. A molecule of iodide of ethyl combines with a molecule of this substance, giving rise to the iodide of a molecular group, behaving like potassium or sodium, "a true organic metal in all its bearings." The ground of this assertion is, that this iodide of tetrethyl-ammonium, when treated with freshly precipitated oxide of silver, is decomposed with the formation of an oxide of the "organic metal" possessing the main features of potash. This train of investigation has not as yet been adequately pursued; but the fundamental importance of this experiment, in reference to our knowledge of the elemental bodies, cannot be doubted.

"The first memoir on the phosphorus bases, in which the existence of a class of phosphorus bases analogous to the compound ammonias was experimentally established, was published in conjunction with M. Cahours. In three subsequent memoirs these compounds were further investigated with the determination of the differences by which they were discriminated from their nitrogen analogues. We have here presented to us the first example of a diatomic base formed by the action of bromide of ethylene or triethyl-phosphine, in which reaction (as in the similar case of the diatomic alcohols) Hofmann successfully established the formation of an intermediate monatomic bromide, the reaction taking place by two distinct stages. In the third of these memoirs a new class of compound bases is brought before us, containing both nitrogen and phosphorus. Subsequently, in a series of somewhat less elaborate memoirs, the conception of the typical character of ammonia is greatly expanded by the examination of the derivatives of two and three molecules of ammonia.

"As to the researches in reference to the colouring-matter derived from coal-tar, it is only necessary to observe that his inquiries initiated and rendered possible what is now a vast branch of industry. In reference to rosaniline itself (the key of the system), he established the fact, long unknown, that this substance was not an aniline compound at all, but derived from the combination of aniline with toluidine.

"I may lastly mention, as a fitting conclusion to this series of discoveries, an investigation of very wide interest, which has resulted in the construction of the normal cyanides (α) of the monatomic hydrocarbons, formed by the action of chloroform on the primary monamines, which, together with water, are resolved into formic acid and the base whence they are derived; while their isomers (class B), the nitrites, under similar conditions yield ammonia and their corresponding acids. Hofmann has also established the existence of a new class of cyanates (β) of the same monatomic hydrocarbons which, together with water, are resolved into ammonia and their corresponding alcohols, the original class (α) being resolved under the same circumstances into carbonic acid and the primary monamines, as in the experiment of Wurtz before referred to, the whole investigation standing in intimate connection with Hofmann's previous work.

"To estimate the value of these results it is necessary to go through the vast mass of experimental evidence from which they are deduced, which constitutes a body of complete and exact information in reference to one general subject not easily paralleled in the history of chemistry.

"A Royal Medal has been awarded to Mr. William Crookes, F.R.S., for his various chemical and physical researches, more especially for his discovery of thallium, his investigation of its compounds, and determination of its atomic weight; and for his discovery of the repulsion referable to radiation.

"In the year 1861 Mr. Crookes communicated the discovery of a new element, which he had detected by means of a green line exhibited in the spectrum of certain selenium residues which he was examining for tellurium. The element had as yet been found in extremely small quantities only; but yet he was able to prove chemically as well as optically that it was a new substance, which, from some of its reactions, he thought most probably belonged to the sulphur group of elements, and to which he gave the name thallium.

"The investigation of this new substance was eagerly followed out; and by inquiries in various directions he succeeded in obtaining it in larger quantities, though his supply was still most inconveniently small, rendering it necessary to work the same material over and over again, instead of carrying on the investigation of two or more of its compounds simultaneously. This investigation, which had led him to perceive that the new body was a metal, which he isolated, was in progress when (in the summer of 1862) he was induced to send in a preliminary notice of his investigations to the Royal Society, instead of waiting, as he had intended, till the research was complete, in consequence of the publication by M. Lamy (who had been fortunate enough to meet with a comparatively fertile source of the new substance) of a paper in which he described several of its compounds and announced its metallic nature. The complete memoir was presented to the Royal Society early in 1863, and is published in the *Philosophical Transactions* for that year. It contains, among other things, a provisional determination of the atomic weight, giving a mean result of 203·96.

"The atomic weight of an element being a constant of fundamental importance, Mr. Crookes spared no pains in an accurate determination of that of thallium. This research, which extended over several years, is described in a highly elaborate memoir which was presented to the Royal Society in 1872, and is published in the *Philosophical Transactions* for the following year. The various weighings which the investigations required were performed and reduced with the most scrupulous regard to minute accuracy, as the utmost care was taken in the preparation of the chemicals. Though only one method was employed, namely that of determining the weight of nitrate of thallium obtained from a known weight of the metal, the care with which the whole process was conducted, and the near agreement of the different experiments, are such as to lead us to regard the final mean 203·642 as most probably very near the truth.

"In the course of the weighings which were executed in this research, Mr. Crookes noticed some minute anomalies depending on temperature which did not seem referable to currents of convection. This led him into a train of experimental research which resulted in the discovery of an action of radiation, which, whatever be its real nature (a point still involved in mystery) and whether the action be direct or indirect, all who have seen or followed the experiments must allow to be most remarkable. An account of this research was published in the *Philosophical Transactions* for 1874.

"When delicate beams of straw and other materials, carrying pith balls or disks at their ends, were mounted so as to turn as freely as possible within glass vessels from which the air could be exhausted, it was found that at atmospheric pressure the approach of a hot body produced a movement usually indicative of an attraction, real or apparent, between the ball and the body, and that of a cold body a reverse movement. In these motions, however, it is evident that currents of convection play a leading part; nor does it appear by any means certain that the actions may not be due to these and other well-known causes. The same thing continues when the air is partially exhausted, until, at a certain high rarefaction varying according to circumstances, the motions cease, or nearly so. But on passing this, a new and unexpected phenomenon is revealed, which is exhibited in perfection in chemical vacua, and in the best vacua produced by the Sprengel pump with the improvements which Mr. Crookes has introduced into it. The suspended body is now repelled with striking energy when a source of radiant heat or light is presented to it, or even, if the radiation be

powerful, when it is held at some distance, or when the sun's rays concentrated by a lens are thrown upon it. The action has more recently been exhibited by Mr. Crookes in an exceedingly striking form by means of a horizontal four-armed fly delicately mounted on a sharp point, and carrying at the ends of the arms pith disks in vertical planes passing through the arms, the disks being blackened on one face, on the same side for all. The motion depends in this case on a differential action on the black and white faces, the black being repelled.

"It is the mystery attending this phenomenon that gives it its great importance. There is evidently some action going on with which we are not at present acquainted; and there is no saying what a thorough investigation into the cause of the phenomenon may lead to."

PROCEEDINGS OF SOCIETIES.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, December 14th, 1875.

EDWARD SCHUNCK, Ph.D., F.R.S. &c., President, in the Chair.

PROF. SCHORLEMMER exhibited a sample of peat from lagoons in the Sierra Madre, in Mexico. It is very dense and not readily inflammable, giving very little flame, but when once red-hot it burns completely, without requiring much draught, to a perfectly white ash containing much calcium carbonate and a little sodium sulphide, which is derived from glauber salt which the peat contains.

"*Chemical Notes*," by M. M. PATTISON MUIR, F.R.S.E., Assistant Lecturer on Chemistry, Owens College.

I. *On the Solubility of Potassium Perchlorate in Water.*

Having a small quantity of pure potassium perchlorate at my disposal, I thought it might be interesting to determine the solubility of this salt in water at different temperatures.

The apparatus employed was similar to that described by Hannay (*Journ. Chem. Soc.* [2], xii., 203).

The salt was placed in a small test-tube to which a thermometer was strapped, the whole being surrounded with ice or water maintained at the proper temperature.

The following were the results obtained:—

A. Temperature 0° C.

Weight of liquid in the bulb, 4·722 grms.
Weight of residue on evaporation, 0·0333 grm.
Weight of distilled water contained in the bulb at 0°, 4·7575 grms.
Weight of bulb itself, 5·3954 grms.

Hence the specific gravity of an aqueous solution of this salt saturated at 0° equals 1·0005; the percentage of salt in solution is 0·705; and the solubility of the salt is 1 part in 142·9 parts of water.

B. Temperature 25° C.

Weight of liquid in bulb, 4·7418 grms.
Weight of residue on evaporation, 0·0907 grm.
Other weights as before.
Specific gravity of aqueous solution saturated at 25°, 1·0123.
Percentage of salt in solution, 1·92.
Solubility, 1 part in 52·5 parts of water.

C. Temperature 50° C.

Weight of liquid in bulb, 4·798.
Weight of residue on evaporation, 0·243.
Specific gravity of aqueous solution saturated at 50°, 1·0181.
Percentage of salt in solution, 5·07.
Solubility, 1 part in 15·5 parts of water.

D. Temperature 100° C.

Weight of liquid in bulb, 4·9965.
Weight of residue on evaporation, 0·7870.
Specific gravity of aqueous solution saturated at 100°, 1·06603.
Percentage of salt in solution, 15·76.
Solubility, 1 part in 5·04 of water.

For each rise of 25° the solubility and the percentage of salt in solution increase in round numbers threefold.

I may add that I found Hannay's apparatus exceedingly accurate and serviceable.

II. *On Basic Bismuth Perchlorate.*

If metallic bismuth be heated with an aqueous solution of perchloric acid, it is slowly converted into a white non-crystalline mass. This substance is insoluble in water: when thoroughly washed and dried between folds of blotting-paper it presents the appearance of a bulky, pure white powder which it is difficult to obtain equally divided as the particles tend to gather together and form small more or less compact masses. This substance yields the following numbers on analysis:—

(*a*) 0·3640 grm. gave 0·2675 grm. Bi_2O_3 = 0·2382 grm. Bi.
(*b*) 0·4173 ,, ,, 0·2980 ,, ,, = 0·2670 ,, ,,
(*c*) 0·4500 ,, ,, 0·3231 ,, ,, = 0·2900 ,, ,,

	Calculated for $BiO.ClO_4$.	Found.		
		I.	II.	III.
Bismuth	210 .. 64·52	65·44	63·98	64·44

These numbers agree very well with those required by the formula $BiO.ClO_4$, or it may be written—

$$Bi(ClO_4)_3.Bi_2O_3.$$

Basic bismuth perchlorate is almost perfectly insoluble in water even at 100°: it is very readily dissolved by hydro-

Date, 1875.	Weather.	Place and Time.	Temp.	Barom.	Wind.	Vols. of CO_2 per 10,000 of Air.
Aug. 2.	Fine, but cloudy.	In boat, ½ mile from shore; 12 noon.	16·5°	767 m.m.	W. by S.	3·87
,, 4.	Clear, cloudless sky. Sunset.	On shore, 8 p.m.	21°	760 ,,	W. by N.	3·88
,, 14.	Fine, fresh breeze.	200 yds. from shore, 3 p.m.	21°	760 ,,	S.W.	3·34
,, 18.	Fine, very clear; very heavy rain during preceding night.	On shore, 8.30 a.m.	16°	759 ,,	N.W.	3·40
,, 21.	Fine, very clear; rain during morning.	In boat, ¼ mile from shore; 2.30 p.m.	17·5°	767 ,,	N.W.	3·84
Sept. 3.	Fine, showers during preceding days.	300 yards from shore.	16°	759 ,,	N.W.	4·01

Mean = 3·72 vols. CO_2 per 10,000 of air.

chloric or nitric acid; less readily by sulphuric acid; at a red-heat it is decomposed with formation of bismuth chloride which is slowly volatilised.

III. *On the Amount of Carbon Dioxide in the Air of Sea-Coast Places.*

Thorpe (*Journ. Chem. Soc.* [2], v., 189) has shown that the air over the ocean contains less carbon dioxide than air over the land, the mean numbers being 3·0 and 4·04 vols. per 10,000 of air respectively.

During the long vacation I interested myself with a few experiments upon the air of the sea-coast, with a view to determine whether it inclined, as regards carbon dioxide, to sea air or to land air.

The samples of air were collected at Ardrossan, a small town on the Firth of Clyde, where the river is almost entirely merged in the open sea.

The estimations were conducted in accordance with Pettenkofer's method.

The air of such a place as Ardrossan, although it be situated almost in the open sea, is not therefore influenced by the sea, so far as the carbon dioxide is concerned, but contains almost the same amount of that gas as is found in land air.

CORRESPONDENCE.

"IN ABSENTIA" DEGREES.

To the Editor of the Chemical News.

SIR,—Some attention having been recently directed to the importance of judging men rather by what comes before than by the letters which follow their names, it may possibly interest some of your readers to know that—even in the matter of degrees—whilst some men "achieve greatness," others have "greatness thrust upon them."

About five years ago I wrote to an individual who advertised himself as willing to assist gentlemen in obtaining Ph.D. and other distinctions *in absentia*, asking him to give me some particulars of this mysterious process, and was informed that for a small fee "a suitable Literary petition in Latin would be written and submitted, with my biography, &c., and his best recommendations to the Senatus Academicus of any University I might select." My curiosity having been satisfied, I did not reply to this or any subsequent communication, but since that date Dr. —— has been one of my most constant and disinterested correspondents. I have now in my possession twenty-eight letters, circulars, cards, &c. (the last to hand a few mornings since), and many others have been accidentally destroyed. In one of these he takes considerable pains to explain to me, a countryman, the exact situation of his abode, that I may have no difficulty in consulting the oracle. In another he says—"Next week being Whit week I have no doubt you will be in London; please call on me." In another I am informed that, "since he last wrote, the Deans of several Colleges and Universities have sent to several gentlemen their diplomas, and they are much pleased with them, as they are very handsome documents." Having waited long enough for the vision of these "handsome documents" to produce a due effect on my mind, he wrote—"I have the honour to inform you that the Senatus Academicus of the University (*sic*) has instructed me to state that the degree you applied for will be granted you on receipt of the fees." This overwhelming condescension on the part of the "Senatus Academicus" not meeting with a suitably eager and grateful response, he again wrote—"I am afraid, from your silence, that the fees are the obstacle to your promotion, and, as I am very anxious that you should receive your degree at once, I pray you to express to me, in confidence, the arrangement you would desire." No comment on the above is necessary. We need not be surprised that Doctors differ.—I am, &c.,

F. BADEN BENGER.

7, Exchange Street, Manchester,
January 6, 1876.

A CORRECTION.

To the Editor of the Chemical News.

SIR,—In my "Note on the Chalybeate Water at Sellafield, near Whitehaven" (CHEMICAL NEWS, vol. xxxii., p. 309), I regret to find that I have made an error in copying the analysis of the clayey earth (therein alluded to) from my laboratory notes. I will therefore thank you to kindly give publicity to this letter, as a correction.

The tabular analysis of the "clayey earth" should have read as follows, as it appears in my notes taken at the time of analysing:—

Silica	40·24
Alumina	38·62
Ferrous oxide	10·73
Ferric oxide	0·70
Manganous oxide	2·00
Calcium carbonate	5·30
Calcium sulphate	2·05
Loss or undetermined	0·36
	100·00

—I am, &c.,

WILLIAM H. WATSON.

Braystones, near Whitehaven,
January 11, 1876.

PEROXIDE OF HYDROGEN AS A HAIR DYE, OR BLEACHER.

To the Editor of the Chemical News.

SIR,—In the admirable "Report on the Development of the Chemical Arts during the last ten years," by Professor Hofmann, he states, in your impression of the 7th inst. (CHEMICAL NEWS, vol. xxxiii., p. 3), that the expensive liquid used to impart a golden hue to the hair was, with respect to its composition, a secret until 1874, when Schrötter analysed it and proved it to be a solution of peroxide of hydrogen. In my Report on Public Health (*Dublin Medical Journal*, November, 1869), I stated that "a specimen of colourless fluid, used at the present time for the purpose of giving dark hair the fashionable, *i.e.*, yellow colour, was submitted to us for analysis. Very much to our surprise we found it to consist solely of solution of peroxide of hydrogen, or oxygenated water. Curiously enough, chlorine, instead of bleaching hair, rather darkens its hue." In my "Manual of Public Health," page 249, I give a formula for a yellow dye (H_2O_2) for the hair. My discovery in 1857, that urea is as effective as ammonia in furnishing nitrogen to plants, has not prevented one French and two German chemists from making the same discovery in later years.—I am, &c.,

CHARLES A. CAMERON.

Royal College of Surgeons, Dublin,
January 10, 1876.

PERIODIC LAW SHOWING EXISTENCE OF A SIMPLE RELATION AMONG THE ELEMENTS.

To the Editor of the Chemical News.

SIR,—With reference to the paper by M. Mendeleeff, translated from the *Comptes Rendus* of November 22nd 1875, which appeared in the CHEMICAL NEWS, vol. xxxii., p. 293, I have to make the following remarks:—

1st. The periodic law showing the existence of a simple relation among the elements when arranged in the natural order of their atomic weights was first published by me in the Chemical News for August 20th, 1864, (vol. x., p. 94). I again called attention to it in the same journal for August 18th and 25th, 1865, (vol. xii., pp. 83 and 94), and on March 1st, 1866, read a paper on the subject before the Chemical Society. All this was some years before M. Mendeleeff had printed anything upon the question.

2nd. With regard to the application of such a law to indicate the gaps which exist in the system of the known elements, I may mention that in the Chemical News for July 30th, 1864 (vol. x., p. 59), I pointed out that in the group of elements containing carbon, silicium, titanium, and tin, there was an element wanting having an atomic weight of 73; being, in fact, the eka-silicium of M. Mendeleeff.—I am, &c.,

John A. R. Newlands, F.C.S.

Amsterdam, January, 3, 1876.

SODA TESTS.

To the Editor of the Chemical News.

Sir,—The correspondence which has recently appeared in the Chemical News fully confirms the accuracy of my remarks on "Liverpool soda tests" made in my inaugural address to the Newcastle Chemical Society lately reprinted in your Journal. Will you allow me to state, in reply to Mr. A. Norman Tate's candid and courteous letter, of last week, that I have no doubt that there are many chemists in Liverpool who always carefully and fairly test samples of soda-ash and caustic soda submitted to them, and that I am quite satisfied he is one of these. He is not the chemist referred to as certifying a sample of caustic soda contained 60 per cent of water which only contained 57·0 per cent. In further reply to his inquiries, allow me to state that the said sample was a sample of "cream" caustic soda, and that the portion tested by me was from the identical bottle sample tested by the other chemist. But this is not a solitary case. There are hundreds and perhaps thousands of similar cases in which the Liverpool test has been from one to three per cent above the proper amount—cases well known to many persons in the trade, and well known to several analytical chemists, who have long considered this state of things as one of the greatest disgraces to the profession. For obvious reasons it would be unwise to mention names.

I must courteously but emphatically state that I think Mr. Tate is in the wrong in dealing with the fractions of percentages in the way he describes. I have always understood that in the alkali trade no fractions, not even 0·9, are charged or paid for; and this will not be considered very unreasonable or hard upon the seller when it is remembered that the whole commercial test gives the latter the advantage of about 0·7 of a per cent in a 52 per cent alkali. But whether this be the custom or not, I maintain that no chemist ought to give a certificate that a sample contains 53 per cent of soda when he knows that it only contains 52·5 per cent. It appears to me that the proper thing to do is to state that the sample contains 52·5 per cent of soda and leave the buyer and seller to arrange how the fraction has to be dealt with.

With regard to the letter of Mr. Samuel Hall, I have to say that every chemist who tests soda-ash for buyer and seller, filters, or ought to filter, the portion soluble in water from the insoluble portion before the test acid is added. If this be neglected, the carbonate of lime in the insoluble portion will neutralise the test acid and be reckoned as soda, and thus a door for a very serious fraud would be opened. It is the custom in some works, in order to save time and trouble, to test the sample without filtering, and make a deduction for the amount of carbonate of lime which, from experience, the sample is known to contain. Mr. Hall is, I think, mistaken in assuming that the difference between his tests and Messrs. Teschemacher and Smith's arises from his filtering the samples and these gentlemen not doing so. I happen to know that Messrs. Teschemacher and Smith, as might be expected, always filter their samples of soda-ash before testing. The differences pointed out are just about equal to those which would arise from using test acid based on the equivalent of sodium = 23 and test acid based on the old equivalent of sodium, 24 (the English commercial test).

In conclusion, let me remind those chemists who test soda with acid made on the correct chemical equivalent of soda that in converting their results into the English commercial test 31 parts of soda by the theoretically correct test are equal to 31·41 parts of soda by the commercial test, and not 32 parts as has been sometimes erroneously assumed by chemists. This error was pointed out by me in a letter which appeared in the Chemical News of the 27th of June, 1870.—I am, &c.,

John Pattinson.

75, The Side, Newcastle-on-Tyne, January 10, 1876.

SODA TESTS.

To the Editor of the Chemical News.

Sir,—Soap-makers are greatly indebted to you for the space you have given to your correspondents under the above heading. Whether it will end in testing soda-ash chemically, or retaining the present system of merely a *commercial examination*, and also whether the equivalent shall be 32 or 31, remains yet to be seen. I protested in my former letter against our having to pay, as soap-makers, the price of soda for that which is of no value to us; and I can confirm, by my own experience, the statement of Mr. Hall, in your impression of last week (vol. xxxiii., p. 8). Some twelve years since, I elicited from a London commercial analyst, in reply to a question, that the soda-ash sent for certificate was tested with all its impurities in it; therefore, whatever quantity of test acid was used, represented real soda: "*we have no time to go beyond that*," he said.

Again, there is, as I have heard, a difference of opinion among the analysts as to the colour of litmus test-paper at the point of saturation, some insisting on full redness: Faraday said the delicate tint of the inside peel of an onion is the proper one.—I am, &c.,

A Soap Maker.

Southwark, January 11, 1876.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences. No. 23, December 6, 1875.

Distribution of Magnetism in the Interior of Magnets.—MM. Trève and Durassier.—In this paper, which cannot be intelligibly abstracted without the accompanying diagrams, we find the interesting observation that those parts of a magnet where its force is greatest are less readily attacked by acids than its neutral or central parts.

Panification in the United States, and on the Properties of the Hop as a Ferment.—M. Sacc.—The author holds that there exists in the hop a ferment more powerful than that which exists in beer-yeast. It is soluble

in water, and has the property—unique among ferments—of resisting the action of boiling water.

Influence of the Defoliation of the Beet on the Yield of Sugar.—M. B. Corenwinder.—The author finds that defoliation reduces the gross amount of the crop, causes a notable amount of the sugar to disappear, and induces the plant to take up a further amount of saline matter from the soil, thus deteriorating the yield of sugar, both in quantity and quality.

No. 24, December 13, 1875.

Laws of Magnetic Influence.—M. J. Jamin.—Incapable of useful abstraction.

Theory of Refining Glass.—M. E. Fremy.—The difficult portion of the manufacture of glass is the process of refining, the object of which is to render the mass homogeneous, and expel as far as possible the bubbles of gas which are produced in abundance at the moment when the glass is formed. The nature of this gas is not exactly known, but it is evidently due to the action of reducing agents upon the sulphate of soda found in excess in the glass. This excess of sulphate of soda is destroyed by various methods, but chiefly by the use of sticks. At the instant when the sulphate of soda is thus submitted to the action of an organic body, the formation of sulphide is proved by the yellow colouration which the glass assumes, but which disappears afterwards from the action of oxygen. It is curious to point out here a certain analogy between refining glass and refining copper. In the former case the excess of the sulphate of soda, which is the agent of vitrification, is destroyed by wood. In copper refining oxygen is the agent of purification for the metal: but the excess of this gas forms protoxide of copper, which dissolves in the metal, and renders it brittle. The refining of copper, like that of glass, is therefore completed by making use of wood, which decomposes the oxide of copper, and restores to the metal all the useful properties which the oxygen had caused it to lose.

Heat of Solution of Precipitates and other Bodies Sparingly Soluble.—M. Berthelot.—Reserved for insertion in full.

Researches on the Sulphines.—M. A. Cahours.—The author investigates the mutual action of bromide of acetyl with sulphide of methyl; of iodide of acetyl with sulphide of methyl; of bromide of cyanogen and sulphide of methyl; iodide of methyl and sulphocyanide of methyl; and iodide of ethyl with sulphide of ethyl.

Temperature of Elevated Regions of the Atmosphere.—M. D. Mendeleef.—(Second memoir). The author gives a demonstration of his theory concerning the excess of temperature in the upper strata of the atmosphere.

Destruction of Vegetable Matter mixed with Wool.—MM. J. Barral and Salvetat.—The authors point out that the fragments of vegetable matter mixed with Australian and South American wools have proved a great inconvenience to manufacturers. The chemical process for their removal is based upon the fact that vegetable matter treated with sulphuric acid at 4° to 5° B., and then heated in a stove to 125° to 140°, is disintegrated. This method was patented by M. Frézon. M. Joly, instead of sulphuric acid, uses a solution of the hydrochlorate of alumina, stoving afterwards at a rather higher temperature. M. Chevreul has shown that in this process the hydrochlorate of alumina acts by its specific properties, and not by the liberation of hydrochloric acid.

Researches on the Constitution of Fibroin and of Silk.—MM. P. Schützenberger and A. Bourgeois.—The authors arrives at the results that fibroin is distinguished from albumen by the almost entire absence, amongst the products of its hydratation of acids of the series—

$$C_nH_{2n-1}NO_4;$$

by a much smaller proportion of amidic acids of the acrylic series

$$C_nH_{2n-1}NO_2;$$

and by the fact that the amidic acids of the series—

$$C_nH_{2n+1}NO_2,$$

which form its principal mass, are the inferior homologues ($n=2, 3, 4$) of those which prevail in the albumenoids ($n=6, 5, 4$). Silk yields more ammonia, oxalic, carbonic, and acetic acids than fibroin.

Comparative Study of the so-called Instantaneous Electric Efflux, and of the Continuous Current in the case of Unipolar Excitement.—M. A. Chauvet.—This paper requires the accompanying diagrams.

Action of Flames in Presence of Electric Bodies.—M. Douliot.—All the phenomena presented are such as might have been foreseen if for the flame there were substituted a conductor insulated and armed with points in all directions.

Sulphocyanates of Acid Radicals.—M. P. Miquel.—By heating together 78 parts chloride of acetyl and 161 parts sulphocyanide of lead, there are formed chloride of lead and sulphocyanate of acetyl. This compound passes over at 135° without traces of decomposition.

Saccharification of Amylaceous Matters.—M. Bondonneau.—The author holds that each amylaceous molecule, before arriving at the final state of glucose, passes successively through the following stages:—

	Rotatory Power.	Action of I.	Action of Absolute Alcohol.
Amylogen	216	blue	insoluble
Dextrin, α.. ..	186	red	,,
Dextrin, β.. ..	176	colourless	,,
Dextrin, γ.. ..	164	,,	soluble
Glucose	52	,,	,,

Influence of Defoliation on the Weight and Saccharine Richness of Beet-Root.—MM. P. Champion and Pellet.—The authors dispute the theory of M. Violette, but they nevertheless admit his practical conclusion that the removal of leaves reduces both the gross weight of the crop and the percentage of sugar.

Justus Liebig's Annalen der Chemie,
Band 179, Heft 1 & 2.

On Certain Methyl- and Benzyl-Selenium Compounds.—C. Loring Jackson.—The compounds examined are the monoselenide of methyl $(CH_3)_2Se$, the selenide-nitrate of methyl, the selenide-chloride $(CH_3)_2SeCl_2$, the corresponding bromine compound $(CH_3)_2SeBr_2$, and the iodine $(CH_3)_2SeI_2$, and the methyl-selenide-platinum chloride $[(CH_3)_2Se]_2PtCl_4$. Among the benzyl compounds described are the benzyl monoselenide $(C_7H_5CH_2)_2Se$, the nitrate, chloride, and double-platinum compound $[(C_7H_7)_2Se]_4PtCl_4$. The author has also examined benzyl-diselenide $(C_7H_7)_2Se_2$, benzyl-selenious acid $(C_7H_7)SeOOH$, with its ammonium, silver, sodium, barium, and lead salts, and certain selenines.

Products of the Action of Chlorine and Bromine upon the Aldehyd of the Ethyl Series.—A Pinner.—The first effect of chlorine upon aldehyd, along with the formation of hydrochloric acid and of chlorine, substitution-products of aldehyd, consists in its polymerisation. Among the resulting bodies is croton-chloral, the properties, decompositions, and products of which are described at some length. The author has made a variety of experiments with the view of elucidating the constitution of croton-chloral, but all with a negative result.

Products of the Action of Hydrocyanic Acid upon Chloral and Croton-Chloral.—A. Pinner and C. Bischoff.—The authors describe, in this paper, chloral cyanhydrate

trichlorolactic acid, trichlorolactic-ethyl ether, croton-chioral cyanhydrate and trichlorangelactic acid.

Contributions to the History of Diethyl-Urea.—Victor von Zotta.—An examination of the action of nitrous acid upon diethyl-urea.

On Isomeric Sulpho-Salycilic Acids.—Ira Remsen.—The author obtains two isomeric sulpho-salycilic acids.

Communications from the Laboratory of the University of Freiburg, in Breisgau.—These consist of a paper on the decompositions which the sulphocyanide of ammonium undergoes at elevated temperatures; a memoir on melamin; contributions to the history of sulphurea; a note on chloro- and brom-sulphurea; a paper on brom-ethyl sulphurea, and one on the thioprussiamic acids.

Constitution of Mesitylen.—A. Ladenburg.—A hypothetical paper, not adapted for useful abstraction.

On Diphenylen Disulphide.—C. Graebe.—This substance, $C_{12}H_8S_2$, crystallises in colourless shining prisms, fuses at 154° to 155°, sublimes in needles and boils at 360°. It is insoluble in water, very sparingly soluble in cold—but more freely in boiling—alcohol. Benzol, ether, and bisulphide of carbon dissolve it readily. In concentrated sulphuric acid it dissolves slowly in the cold, but more quickly if heated, giving an intense violet colour.

On Rosolic Acid.—C. Graebe and H. Caro.—The authors have subjected the behaviour of rosaniline with nitrous acid to a new examination. Their paper will be inserted in full at our earliest convenience.

Communications from the University Laboratory of Prof. A. Fleischer, at Klausenburg.—These consist or a memoir, by Prof. Fleischer, on dithiocyanic acid, and a paper, by the same author, on certain double salts of sulphocyanide of ammonium.

Action of Chlorine upon Pyrogallol.—J. Stenhouse and C. E. Groves.

Crystallographic Properties of Mairogallol.—W. J. Lewis.—These two papers are translated from the English.

Remark on F. Kopfer's Dissertation, "The Action of Mineral Acids upon Chloride of Lime."—W. Walters.—The author controverts Kopfer's statement that chloride of lime, on treatment with minute quantities of acid, yields only monoxide of chlorine.

On Glutaminic Acid.—J. Habermann.—An account of some of the salts of this acid.

Bulletin de la Société d'Encouragement pour l'Industrie Nationale. No. 24, December, 1875.

Report Presented by M. Baude on behalf of the Committee of the Economic Arts on a Process for the Analysis of Cements, and on the Adjunct for Moderating the Rapidity of Setting, by M. Ducourneau.—The process for the analysis of cements herein referred to is not described. It consists in a series of decantations.

Description of the Tubular Electro-Magnet of M. Camacho.—This description of the Camacho electro-magnet is accompanied with engravings.

Les Mondes. Vol. xxxviii., No. 16. December 16, 1875.

Death from the Sting of a Bee.—At Crèvecœur, in September last, a young woman of the age of twenty-four died in a few minutes from the sting of a single bee on the left cheek. The deceased had been strong and healthy, but having on a former occasion been stung by a bee she had remained for several hours apparently dead.

The Goux Earth Closet System.—This system is in successful operation in the town of Amiens and in its vicinity, and the manure gives very satisfactory results.

M. Reimann's Farber Zeitung, No 47, 1875.

This issue contains an account of the meeting of the Berlin Association of Dyers. Dr. Reimann read a very interesting paper on the manufacture and application of eosine. There are receipts for dyeing an aniline-violet on mixed garments, for a brown, light brown, cinnamon and light olive on wool and woollen yarn, and for a fast black on cotton yarn.

No. 2, 1876.

Wool-Dyeing with Methyl-Green.—The process which has been found satisfactory in a number of establishments consists in boiling the wool for fifteen minutes in a solution of hyposulphite of soda, 3 grms. to 600 grms. water, and when the wool is thoroughly penetrated with the liquid adding 2 grms. sulphuric acid. The bath after taking out the wool must be perfectly clear, and the vessel employed must not consist of copper, lead, or iron. If the hyposulphite of soda is employed too strong the wool does not "handle" well and the green appears somewhat flat. No trace of a metallic compound must be present. The dyeing is then performed in an aqueous solution of methyl-green. If a yellowish tone is required picric acid and acetate of zinc are mixed in the proportions of 600 grms. water, 0·07 grm. picric acid, and 0·06 grm. acetate of zinc. After dyeing yellow in this beck, a little acetate of soda is added, and the dyeing is then completed with 0·2 grm. methyl-green.

MISCELLANEOUS.

Mineralogical Society of Great Britain and Ireland.—It has been arranged to hold the first General Meeting, for election of Officers, adoption of Rules, &c., at the rooms of the Scientific Club, 7, Savile Row, London, on Thursday, February 3rd, at 12 noon. The chair will be taken by Mr. H. C. Sorby, F.R.S., &c.

Death of Mr. S. T. Davenport.—We regret to have to announce the death of Mr. S. T. Davenport, well known as an active and energetic officer of the Society of Arts. Mr. Davenport's connection with the Society had lasted for thirty-three years, and it was in great part to his unceasing and zealous efforts that the present prosperity of the Institution is due. To very many of the members he was well known, and all who take an active interest in the Society of Arts will feel his loss severely. Mr. Davenport's death was very sudden; it took place on Friday last, after an illness of only four days.

Metropolis Gas Supply.—Dr. Letheby, the chief Gas Examiner appointed by the Board of Trade, has recently reported—to the Metropolitan Board of Works and the Corporation of the City—on the illuminating power and chemical quality of the gas supplied to London by the Chartered, the Imperial, and the South Metropolitan Gas Companies. In all there are nine testing-places, where the gas from the several works of these companies is tested every evening, between the hours of 5 and 10 o'clock, and the following are the average results for the quarter:—The illuminating power of the Chartered Gas, at Beckton, has been equal to the light of 16·91 standard sperm candles; at Friendly Place, Mile End, it has been equal to 16·63 candles; and at Ladbroke Grove to 16·93 candles. That of the Imperial Company, at Carlyle Square, Chelsea, has been equal to 16·44 candles; at Camden Street, Camden Town, to 16·28; at Graham Road, Dalston, to 15·70 candles; and at Bruce Terrace, Bow, to 16·22 candles: while that of the South Metropolitan Company, at Hill Street, Peckham, has been equal to 16·25 candles.

In the case of the Cannel gas of the Chartered Company the illuminating power has been equal to 21·02 candles. In all cases this illuminating power is obtained by burning the gas at the rate of 5 cubic feet an hour, from suitable burners, as prescribed by the Referees appointed by the Board of Trade. On four occasions during the quarter the gas of the Chartered Company, at Beckton, was a little below the parliamentary standard. As regards purity, Dr. Letheby reports that sulphuretted hydrogen was, with two exceptions, at all times absent from the gas of all the companies. The two exceptions were in the case of the gas at Beckton, when, from accidental causes, there was a trace of this impurity present. The average proportions of sulphur in the gas have been as follows:—Beckton, 12·67 grains per 100 cubic feet; Friendly Place, 10·59 grains; Ladbroke Grove, 12·99; Millbank, 17·12; Chelsea, 10·38; Camden Town, 17·91; Graham Road, 13·77; Bruce Terrace, 11·45; and Hill Street, Peckham, 21·99 grains. The proportion of this impurity has been in excess of the prescribed amount (25 grains per 100 cubic feet) on four occasions in the Imperial Gas, at Camden Street, and on fourteen occasions in that of the South Metropolitan Gas. Dr. Letheby states that the excess of impurity in the Imperial Company's gas was accidental. The amount of ammonia in the gas of all the companies has been constantly below the prescribed quantity of 2½ grains per 100 cubic feet of gas. In most cases it has been considerably less than 1 grain per 100 cubic feet.

Important Decision versus the Employment of the "Lactometer" used by the Board of Health, of New York City, as a Means of determining Adulteration of Milk.—On September 16th, 1875, a German milk dealer was convicted, in one of the lower Courts, of "the misdemeanour of keeping and exposing for sale adulterated milk." The prosecution relied entirely upon the fact that milk found in the shop of the accused, when tested by the lactometer, failed to attain the standard which is said to denote pure milk. Prof. Doremus, as expert for the defence, demonstrated by experiments that the employment of the lactometer enabled the fraudulent vendors of milk in the country to remove much of the cream, and also to add water to the half-skimmed milk. He also testified that milk from certain cows, during certain seasons of the year, would yield a pure milk liable to condemnation when criticised by this untrustworthy instrument; that he visited, in the month of September, a celebrated milk and butter district (Orange County, New York State), and obtained twelve specimens of milk from as many pasture-fed cows, five of which samples were of less gravity than the standard adopted by the Board of Health. Chemical analysis showed their richness in butter to be the cause of their want of buoyant power. Dr. Doremus also referred to various French, German, and English authors, as substantiating his views, and quoted the sweeping denunciation of the lactometer by Mr. J. Alfred Wanklyn, in his work on "Milk Analysis." Justice John R. Brady, in reversing the judgment of the lower Court, said, that if—by tests made by scientific men—the lactometer or lactodensimeter furnishes only questionable evidence of adulteration, it should not be regarded as sufficient to warrant a conviction.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

A new or improved mode and means of preventing the deposition of sediment and incrustation in steam boilers. G. Nimmo, Glasgow. November 23, 1874.—No. 4018. This said invention consists in placing within the water in the boiler bags, pads, or "sweeps," made of cotton-waste, hemp, rope, or other soft material (or pieces of wood covered with a soft material), which, when saturated, possess a specific gravity rather heavier than the water; so that these, by the ebullition or boiling of the water, and by their own shape or configuration, rise and fall in and agitate the water, so as to keep the sediment in motion and prevent it from settling or depositing in the boiler, and so prevent incrustation. When the boiler is to be cooled down, the sediment is blown or drawn out through a pipe and cock for that purpose. When used for either single or double flued Cornish boilers, or multiple tubular boilers, the bags, pads, or "sweeps" are made sufficiently thin to pass between the flues and the shell, or between the tubes themselves, so as to brush and clean them.

Improvements in the manufacture of air-gas for lighting and heating purposes, and in the apparatus connected therewith. C. F. Schüssler, Hamburg. November 23, 1874.—No. 4021. The novelty of the invention consists in the production of a heating and illuminating gas by the construction of a chamber containing tubes or channels in which hydrocarbon liquid is caused to flow and impregnate atmospheric air, which is then driven under pressure of an arrangement of bellows worked automatically.

Improved compounds or combinations of ingredients for waterproofing filaments, threads, fabrics, and fibrous materials generally, also for coating walls and other bodies. A. Wilkinson, High Street, Marylebone, Middlesex. November 23, 1874.—No. 4026. This relates to forming a composition of ingredients, such as bisulphuret of carbon, benzine, sulphuret of zinc, ammonia mixed with naphtha, india-rubber, gutta-percha, or other like gum, for the purposes stated in the title. In some cases an exterior coating, composed of sugar of lead and linseed oil mixed with whiting and litharge, is applied, and before being completely dry an extra coating of the first mentioned composition is applied to render the materials completely waterproof.

Certain improvements in the manufacture of acetate of soda, and in the processes employed therefor. H. B. Condy, Battersea, Surrey. November 24, 1874.—No. 4037. The novelty of the invention consists in precipitating the organic impurities existing in acetate of lime, and the completion of the decomposition of the solutions of acetate of lime or sulphate of lime (which is dissolved to a small extent) by means of carbonate of soda. The combination of such processes enable me to produce good merchantable acetate of soda by one crystallisation.

Improvements in refining saltpetre, and in apparatus for the same. G. Haycraft, Faversham, Kent. November 25, 1874.—No. 4046. My invention relates, first, to the arrangement of the vessels in which the several stages of the refining process are performed, in such a manner that the saltpetre will be caused to pass by gravitation alone from vessel to vessel, whereby hand labour and the use of pumps for lifting the saltpetre from one level to another is dispensed with. Also to the method of boiling the grough saltpetre by introducing steam among the mass, with or without the use of a steam coil. Also to the method of recovering saltpetre from the mother-liquor which drains from the refined saltpetre. Also to the method of cooling the saltpetre during crystallisation, as well as to the construction of the boiling and reducing vats, the agitators, and the arrangement of gearing for driving the same.

Improvements in automatic chemical telegraphs, comprising transmitting and receiving instruments, circuits, and apparatus connected therewith, part of the said improvements being also applicable to other telegraphs. A. M. Clark, Chancery Lane, Middlesex. (A communication from W. E. Sawyer, Washington, Columbia, U.S.A.) November 26, 1874.—No. 4063. The present invention relates to a new and improved system of automatic chemical telegraphs, comprising transmitting and receiving instruments, circuits, and apparatus connected therewith.

Improvements in bleaching wool, textile fabrics, and fibres. T. N. Palmer, Lansdowne Road, Dalston, Middlesex. (A communication from L. P. H. P. Balna, Rheims, France.) November 28, 1874.—No. 4087. I use a bath composed of bicarbonate of soda and subcarbonate of magnesia, into which air is introduced by pressure. I put into an apparatus the above mentioned matters with the addition of sulphuric acid; the gas which is emitted from this apparatus saturates the bath, and in order to continue the application I saturate the same bath with sulphurous gas, accompanied by the introduction of the oxygen of the surrounding air. I also use chloride of lime in the water saturated with sulphurous gas, always with the addition of the oxygen of the air. I reserve to myself the use of all the means producing sulphurous, carbonic, and oxygen gas applied to the bleaching of the above mentioned materials.

A new or improved ink-pencil. J. L. Petit, Birmingham, Warwick. November 28, 1874.—No. 4090. This new or improved ink-pencil consists of aniline dyes, or mixtures thereof, thoroughly incorporated with finely powdered plumbago, or black, or deep coloured chalk, together with gum-water or other adhesive material soluble in water. The paste produced may be made into sticks, and dried, and be used as a crayon or chalk, or be enclosed in cedar as an ordinary black-lead, or be made into fine rods to be used as an ever-pointed pencil. The writing produced by the use of the ink-pencil may be copied by pressing moistened paper upon it. The original writing is thereby made more legible as the moisture dissolves more or less of the aniline compound in the composition, and the dissolved matter dyes the vegetable fibre, and deepens the colour of the writing. Several copies of the writing may be taken. The ink-pencil may be produced in different colours.

Improvements in the method of and apparatus for extracting the juice and crystallisable matter from sugar cane, and after manipulation of the same. G. W. Risien, Demerara. (A communication from William Russell, of Demerara.) November 30, 1874.—No. 4094. The features of novelty which constitute this invention consist in passing the cane stalks through two mills spaced about thirty feet apart and connected by a chamber. In this chamber works an endless band or carrier, and the chamber is provided with two tiers of pipes, through

which a continuous supply of hot water, or steam, or cane juice passes in a spray and saturates the expressed cane stalks or begass on passage of same from mill to mill. The hot water, or hot water and steam, is supplied from the cane juice heaters used in the manufacture of sugar, and the juice from the second mill may also be used for saturation by passing it through a juice heater and then to the supply pipes for saturating the begass before mentioned.

Improvements in apparatus employed in the washing and cleansing of wool and other fibres. J. Clough, Manchester Road, Bradford. November 30, 1874.—No. 4095. In conveying wool or other fibrous material (after being washed) from the washing bowl or trough to the squeezing rollers, a carrying fork is employed, operated by crank motion with balance wheel on the end of the shaft, and worked in a curved plate, the curve of which is suited to the movement the fork is desired to describe; this curve may be flatter or quicker according to the distance the squeezing rollers may be from that part of the bowl or trough where the wool is lifted by the last washing fork and placed upon the curved plate. The curve of this plate begins at the point where the wool is leaving the sud or wash liquor and continues upwards as far as is necessary to give the wool sufficient fall down an incline leading to the nip of the rollers, and so to pass it through the rollers. This curved plate has two sides or guards to prevent the wool from falling off it when being taken forward by the carrying folk to the rollers. Stationary holders are placed at the foot and on the top of the curved plate to retain the wool, when lifted from the bowl or trough and placed upon it, until the carrying folk working in the curve comes and takes such wool forward to the top of the inclined plane, and from whence it slides down to the nip of the rollers. There are holders called ratch tooth holders (by the teeth taking the form of ratch teeth). The head of the carrying fork which works in the curve is fixed upon a square part of the lower end of the "stalk," and is movable up and down it; an adjustable steel spring, being placed on the stalk above the head of the fork, gives way by compression according to the thickness of the body of wool which it may for the time be carrying, and by which it readily suits either a larger or a smaller amount of material under operation. The prongs of this fork are formed slightly rounded at the front part, running out conically to the back part.

Disincrusting and preventing the incrustations in steam boilers. J. B. Deluy, Naples, Italy. November 30, 1874.—No. 4108. My invention is an improvement on all the discoveries made until now; it is the result of my studies, and consists in a powder made out of one only vegetable produce pulverised, which I introduce in the boiler through the manhole when the supply of water is completed. My disincrusting powder, which I name "Disincrustant Marseillais," is neither a compound or a mixture, and it disincrusts, cleanses, clears out all deposit by spontaneous action. By the ebullition the incrustation is dissolved and goes out through the tap purger.

NOTES AND QUERIES.

Terra Alba.—Is the article called terra alba made *entirely* from the ground alabaster of Derbyshire, or is there another kind of terra alba made or *manufactured* at the Salt or Acid Works of Newcastle or elsewhere in England? Assuming that it is also made at the Salt Works as well as at Derbyshire, is the former better in any way, and what is the price per ton laid down at Liverpool? Please give present market prices for the Derbyshire, and that which is manufactured at salt works or elsewhere. There is another article called pearl hardening which I do not wish confounded with the other, but would like the present market price of this also.—THOMAS MANNING.

MEETINGS FOR THE WEEK.

MONDAY, Jan. 17th.—Medical, 8.
—— London Institution, 5.
TUESDAY, 18th.—Civil Engineers, 8.
—— Zoological, 8.30.
—— Royal Institution, 3. "On the Classification of the Vertebrated Animals," by Prof. Garrod.
WEDNESDAY, Jan. 18th.—Meteorological, 7. (Anniversary).
—— Society of Arts, 8.
—— Geological, 8. "On some Unicellular Algæ Parasitic within Silurian and Tertiary Corals, with a Notice of their Presence in Calceola sandalina," by Prof. P. Martin Duncan, F.R.S., V.P.G.S. "How Anglesey Became an Island," by Prof. A. C. Ramsay, LL.D., F.R.S. "On the Influence of Various Substances in Accelerating the Precipitation of Clay Dissolved in Water," by William Ramsay.
THURSDAY, 20th.—Royal, 8.30.
—— Royal Institution, 3. "On the Chemistry of the Non-Metallic Elements," by Prof. Gladstone.
—— Chemical, 8. "On Narcotine, Cotarnine, and Hydro-cotarnine," by G. H. Beckett and Dr. Wright. "On a Method of Estimating Bismuth Volumetrically," by M. M. Pattison Muir.
—— London Institution, 7.
FRIDAY, 21st.—Royal Institution, 8. Weekly Evening Meeting. "The Optical Deportment of the Atmosphere in relation to the Phenomena of Putrefaction," by Professor Tyndall, 9.
SATURDAY, 22nd.—Royal Institution, 3. "On Excavations in Asia Minor," by R. P. Pullan.

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THE CHEMICAL NEWS.

Vol. XXXII. No. 843.

THE NEW PHASE OF ELECTRIC FORCE.

Professor E. J. Houston has kindly forwarded to us an early proof of an article he has contributed to the January number of the *Journal of the Franklin Institute*. Before, however, referring at length to his experiments we will reproduce from the *Scientific American* three diagrams of the apparatus used by Mr. Edison during his experiments.

Mr. Edison and his assistants were experimenting with a vibrator magnet consisting of a bar of steel fastened at one end, and made to vibrate by means of a magnet when they saw a spark coming from the core of the magnet so bright that they suspected something more than induction.

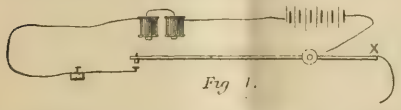


Fig. 1.

The vibrator and battery were then placed on insulated stands, and the wire connected with *x* (Fig. 1) was carried over to the stove about 20 feet distant. On rubbing the end of the wire against the stove, splendid sparks were observed. With the wire permanently connected with the stove, sparks could be drawn from any part of the stove with a piece of metal held in the hand. Again, while the vibrator was in action, a block of iron was placed near *x*, but not touching the bar, nor connected with it in any way except by the wood of the base through the table, and sparks could be drawn from the iron. These experiments were made to show that the supposed new force is not amenable to the laws of voltaic or static electricity.

An experiment was made with the apparatus figured in Fig. 2 to show that the force in action is not induced electricity. All the parts are insulated except the gas fixture. A is the battery; B, a common telegraphic key; C, an electro-magnet; D, a bar of cadmium (or other metal, cadmium being the best) supported by an insulated stand; E is a mirror galvanometer; F, the gas pipe; G, a dark box enclosing pencils with graphite points (common lead-pencils). The unknown current passes from the bar of cadmium through the galvanometer without causing the slightest deflection, and—notwithstanding the gas

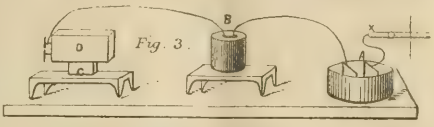


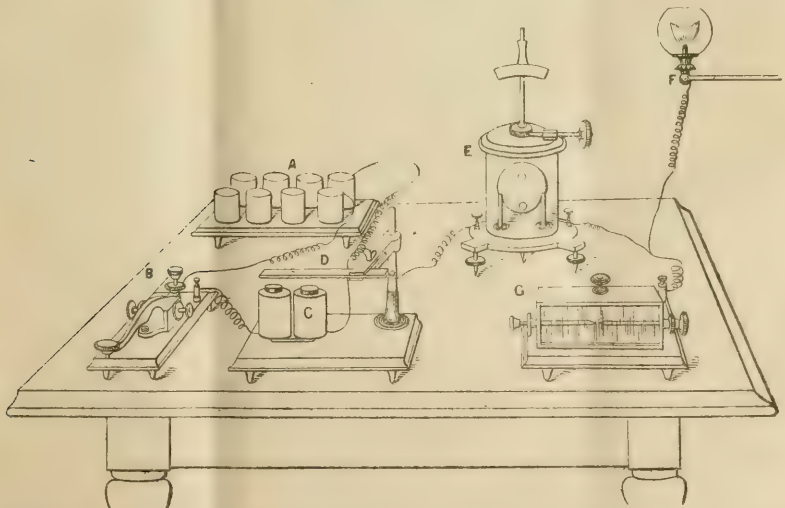
Fig. 3.

pipe connection, which would drain the wire of induced electricity, if there were any—bright sparks are visible between the graphite points in response to the motion of the telegraphic key.

Standing on an insulated stool, the experimenters draw sparks from the following arrangement (Fig. 3), in which *x* is the end of the vibrator (which, as well as the battery, is insulated); A, a secondary battery; B, a 200 ohm coil or copper wire; C is a block of iron, and D, a condenser, all well insulated except A, which is of glass, and stands on the table.

In another experiment a glass rod four feet long with a piece of carbon fixed to one end, was well rubbed with a silk handkerchief over a hot stove, and the carbon point presented to the apparatus, the other end of the rod being held in the hand with the handkerchief; sparks were drawn, yet the galvanometer chemical paper, the sense of shock in the tongue, and a delicate gold leaf electroscope, were not in the least affected by the mysterious current.

Fig. 2.



On December 16 Mr. Edison brought his discovery before the Polytechnic Club of the American Institute. The editor of the *Scientific American*, who was present, says that Dr. Beard gave a very lucid account of the

phenomena, observed by himself as well as by Mr. Edison; and he pointed out in what particulars the new spark is similar to some forms of electricity, and in what it appears to differ from the various known forms of that force. Like a true scientist, he pointed out that only such phenomena as every competent experimenter is able to verify at any time are worth consideration; and he spoke of the sources of illusion and delusion which misled Reichenbach, and afterwards others who asserted that they had verified his alleged discovery of the so-called odic force.

In 1871 Professor Houston published the description of some experiments* which bear, both in method and results, a partial resemblance to those by Mr. Edison. The original experiments, made with a Ruhmkorff induction coil, capable of throwing the induced spark six inches in free air, have now been repeated by Professors Houston and Elihu Thomson. The results are thus described by Professor Houston :—

The induction coil was worked by means of an electropoin battery of ten cells coupled for an intensity of ten. The elements of each cell consist of a single plate of zinc placed between two plates of carbon. The available surface in each cell is about three by six inches. One pole of the battery was placed in metallic connection with a gas-pipe and the other in similar connection with a large insulated conductor. On working the interrupting break-piece a torrent of characteristic white sparks of condensed electricity passed between the platinum points of the coil. Under these circumstances, that is, while the discharges were occurring between the points, sparks could be drawn from all metallic objects in the same room with the coil, or in adjoining rooms. The sparks were especially noticeable when metallic objects were approached to the gas- or water-pipes of the building, or to metallic surfaces in connection therewith, as in the case of the pneumatic trough, steam-engines, and boiler before mentioned. As already implied, actual contact between the gas- and water-pipes and one of the wires leading from the coil, was unnecessary, as distinct sparks were afforded by a stove in the same room, and from another in an adjoining room.

In order to test the suspected similarity between these sparks and those described by Mr. Edison, we submitted them to the tests proposed by him. We made a number of experiments and obtained the following general results, viz.—

First. The gold leaves of a delicate electroscope did not diverge on being brought into contact with metallic objects yielding the sparks, although in every case the sparks could be seen at the point of contact.

Second. The needle of a delicate astatic galvanometer was not sensibly deflected by the sparks, on an apparent current being caused to traverse the coils of the instrument.

Third. A small shred of cotton-wool was not sensibly attracted or repelled by objects from which the spark might be obtained.

Fourth. The so-called retroaction of the spark was distinctly observed. On looping a wire back on itself, a decided spark was seen at the point of contact made by the end of the wire with any portion of the wire itself.

All the above results are in strict accordance with the known laws of electricity, as will appear hereafter.

To still further compare these results with those obtained by Mr. Edison, we dispensed with the use of the induction coil, and employed an apparatus similar to that described by him, viz.,: An electro-magnet in connection with the battery already mentioned, the current of which was rendered intermittent by means of an ordinary interrupter. With this arrangement, a wire in contact with the core of the magnet yielded sparks having all the properties described by Mr. Edison.

From a careful reading of the published accounts of Mr. Edison and Dr. Beard, it appears that the alleged discovery of a new force is based on their failure to obtain from the sparks indications of electrical charges or currents; or in other words, in the apparent absence of electric polarity. All the effects noticed, however, are readily explainable by reference to the presence of an instantaneous outgoing current, immediately followed by an incoming one, with the complete re-establishment of electrical equilibrium. When we bear in mind the enormous velocity of electrical currents of this character, probably some hundred thousand miles per second, we can readily understand that the flow and reversion of the current would take place in an exceedingly small fraction of a second; a space of time sufficient, were the current merely direct, to produce any decided divergence of the leaves of the electroscope or the needle of the galvanometer. *The presence of the inverse current, immediately following the direct current, would absolutely and necessarily prevent the exhibition of electrical polarity as exhibited in the motion of the electroscopes, galvanometers, and of similar instruments.*

It is doubtless due to the fact that the direct and inverse currents are opposite in their effects, and therefore produce instantaneous electrical equilibrium, that Mr. Edison failed to obtain the characteristic twitching of frogs' legs or the discolouration of iodised paper; for, although these results would unquestionably follow an electric current in one direction, their presence would be masked by the opposite effects produced by the instantaneously following inverse current.

The possibility of the existence of the direct and inverse currents, as above described, may be questioned; but when we bear in mind that the sparks can only be obtained by the interruption of the battery current, and that it is necessary to pass the battery current through a long coil of wire, conditions in every way favourable to the production of instantaneous induced or extra currents, the direct and the inverse currents follow as a matter of necessity; for the induced or extra currents in the coil of wire necessarily produce, in the core of the magnet and the metallic wire in connection therewith, an electrical current in one direction, instantaneously followed on the cessation of the induced or extra current, by a current in the opposite direction for the re-establishment of the electric equilibrium in the cores of the magnet.

It is a fact well known to all versed in electrical science that the induced current produced at the moment of making contact with the interrupter flows in the opposite direction to that produced on breaking the contact. This fact would in itself, exclusive of the above explanation, be sufficient to account for the production of inverse currents in the core of the magnet, when the interruption of the battery current was sufficiently rapid. Dr. Beard admits that the phenomena may be referred to a somewhat similar explanation, but the value he attaches to his supposition may be judged from his subsequent adoption of the term "apolic force" as a preferable term to "etheric force."

It is matter of surprise to us that both Mr. Edison and Dr. Beard endeavoured by careful insulation to eliminate in the apparatus employed by them the effects of induced electricity or induction, since it is a recognised fact in electrical science that the more perfect the insulation the more decided the effects of induction, of which, perhaps, no better instance could be found than the care taken to thoroughly insulate the secondary coils in the induction on Ruhmkorff apparatus. In view of the above considerations, we feel warranted in the belief that all the phenomena noticed by Mr. Edison and Dr. Beard are explainable by the presence of inverse electrical currents of considerable quantity, but comparatively small intensity, instantaneously produced at the making or breaking of the battery circuit.

There was noticed during the progress of our experiments with the induction coil the following curious phenomenon, which appears to us favourable to the explanations

* *Journal of the Franklin Institute*, June, 1871.

we have adduced. One of the poles of the coil was connected with a gas-pipe, and the other with an insulated conductor of considerable surface in the room containing the Ruhmkorff core. This room is in connection by a telegraph wire with the chemical laboratory on the floor below, and with an earth circuited station, D, in another building, about 500 feet distant in a direct line. On the interrupter of the coil being worked, a peculiar clicking sound was heard, by both of us in the line wire in the chemical laboratory. The operator at D was requested to observe whether any unusual phenomena were noticed at his instrument. He at once telegraphed to us that a distict "tinkling sound" was heard, which did not vary whether the ordinary battery current of the line was opened or closed. Since he did not know what to expect, his confirmation of our observation was very satisfactory. The production of the sound is probably referable to a rapid succession of molecular changes produced in the wire by the sudden reversion of its electrical states.

Central High School, Philadelphia, December 11, 1875.

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 13.)

THE science of physics reveals three procedures by which a reduction of temperature can be effected, ice being the result if the cooling is sufficiently intense and is applied to water. The methods in question are:—The solution of solids (salts); the spontaneous evaporation of liquids; and the expansion of aëriform bodies. Each of these methods has met with practical applications; the first-mentioned or solution-process for reducing the temperature of small mass in simple apparatus not acting continuously; the two others, evaporation and expansion, for the uninterrupted production of ice in complicated machines.

I. *Cold obtained by Solution.*

Every mixture of substances in proportion as it produces, during solution, the greatest depression of temperature in its own mass is called a freezing mixture. Various mixtures of this kind have long been known, and may be found described in all text-books of physics. The best known and most commonly applied both in domestic and technical affairs pre-supposes the presence of ice. It consists of 3 parts of ice and 1 of common salt, which dissolve each other, whilst the the temperature falls to $-21°$, the freezing-point of a concentrated solution of chloride of sodium. The solution of a part only of the mixture is requisite to produce this low temperature in the entire mass. Not till heat penetrates from without into the mass does a further melting take place, the temperature remaining the same. Consequently the above degree of cold may be kept up till all the ice has been melted with the salt. It is necessary, however, to keep the mixture continually agitated. This snow and salt-freezing mixture is used in preparing ice-creams, for which a temperature of about $-12°$ is required. As the essential point here is the congelation of water and the other substances present may be neglected, as far, at least, as their specific and latent heat is concerned, it is easy to calculate what weight of ice-cream may be prepared with a known quantity of freezing mixture.

The freezing apparatus of the confectioners consists of a tin vessel for receiving the ingredients, placed in a larger bath of wood or tinned copper. The interval is filled with ice and salt, which are constantly stirred that the mutual contact of the two may be perfect. If this is neglected the salt, after a portion of the solution has been formed, sinks to the bottom and ceases to act upon the ice. Since about 1865 a freezing apparatus for domestic use has been introduced from Paris arranged as follows:—A cylindrical pewter vessel with double sides is fitted in the middle of a jacket with two pivots, which rest upon two supports fixed in a block of wood. One of the pivots is prolonged so as to form a handle which serves to keep the cylinder in continual rotation. The two plane ends of the cylinder are disks of wood, which are pressed upon the cylinder by a peculiar arrangement, india-rubber rings being used to preserve complete tightness. The interval between the double sides of the cylinder is filled with a bad conductor of heat. A cone of pewter is introduced into the interior, and can be opened on one side to receive the materials for the ice-cream; the annular interstice is filled with salt and ice, which are introduced from the other side. The lid is put on, and the handle is turned for about five minutes. The lid of the cream receiver is then taken off, and the matter which has become deposited on its inner sides is scraped off with a spatula and stirred up with the still unfrozen residue to a butter-like consistence. The apparatus is closed again, turned for five minutes, opened again, and the contents stirred up as before—an operation which is repeated a third time. In a quarter of an hour the ice-cream is ready. The apparatus acts satisfactorily, but it is troublesome and rather costly.

(To be continued.)

* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzehends."

A STUDY OF HYDROCARBONS.

No. I.—THE CONSTITUTION OF ALIZARIN.

By S. E. PHILLIPS.

THERE are two methods by which we may approach this great subject:—One is to grapple with the minutiæ of details, and thence to try and reduce the interminable chaos to some ordinal principles of classification; and thus it is that acids are grouped according to some ideas of monatomic, diatomic, and polyatomic peculiarities; and the same with alcohols; and between these are more neutral groupings of aldehyds, ketones, quinons, paraffins, olefines, &c., and each series with their corresponding primary, secondary, tertiary, and other subdivisions, while an immense cloud of hypothesis darkens the whole proceeding, and graphic, constitutional, and other efforts of atomic disposition are freely put in requisition, as if to reduce the void to some elements of classification.

This system may be profitably studied in the recent and very valuable works of Armstrong and Schorlemmer.

Another, an older and simpler way, with far less of pretension and hypothesis, is to subordinate very much of all this minutiæ, and to aim at some general grasp of the whole principle of "radical" behaviours; so that, upon this solid basis, the minutiæ of fact and experiment may supervene, to fill in the rugged outline, and stamp it with that quality of simplicity and beauty which—in all departments of human enquiry—is the polar star which both impels and rewards the highest efforts of human labour.

Nor let it be supposed that this aspect looks with coldness upon the Herculean efforts which are so ably summarised in the works referred to, which are published at a popular price out of all proportion to their intrinsic worth; nor should it be thought that we would lessen by one tittle these great efforts to ascertain the meaning of those isomeric or allotropic differences which now multiply at every step. But we do think it is high time that some safe guiding principle should be selected to harmonise the past and fructify the future.

The artificial production of the beautiful "Turkey-red" may well be looked upon as one of the proudest triumphs of modern chemistry; but to one who has closely watched the teeming memoirs and public lectures devoted to its

elucidation, it becomes a painful picture of the really backward state of science which tolerates such vast efforts with so little of fruition in the direction so much desiderated.

A vague idea, very widely prevalent, considers alizarin as diatomic and dibasic, or that in the quinone genesis H_2 are replaced by the divalent group (O_2), &c.

A diatomic phenol is said to be a combination of a hydrocarbon like marsh-gas with 2 atoms of hydroxyl—

$$C_6H_4\begin{Bmatrix}HO.\\HO.\end{Bmatrix}$$

So Perkin, Schunck, and others believe in analogous type representations.

Anthraquinon is therefore—

$$C_{14}H_6\begin{Bmatrix}HO.\\HO.\end{Bmatrix}$$

and alizarin

$$C_{14}H_6O_2\begin{Bmatrix}HO,\\HO,\end{Bmatrix}$$

or, after Graebe,

$$C_{14}H_6\begin{Bmatrix}O_2.\\(HO)_2.\end{Bmatrix}$$

M. Faust has been engaged for some years past upon a very analogous substance called frangulinic acid: at one time he is busy trying to find out whether it has 2 or 3 atoms of hydroxyl—

$$C_{14}H_7O_2\begin{Bmatrix}HO\\HO\end{Bmatrix}\text{ or }C_{14}H_5O_2\begin{Bmatrix}HO.\\HO.\\HO.\end{Bmatrix}$$

It seems clear, first of all, that the acid by deoxidation yields anthracen, thus establishing a kinship with alizarin; then we find the glucoside from the bark of *Rhamnus frangula* contains the elements of—

Acid	+ Glucose	−2HO =	Frangulin.
$C_{28}H_{16}O_8.O.HO$	$C_{12}H_{12}O_{12}$		$C_{12}H_{10}O_{10}\}$ $C_{28}H_{18}O_8\}$ $(C_{40}H_{19}O_{18})O,HO.$

Why not digest this acid with ammonia, under the light of a thousand analogies, and obtain the amide $(C_{28}H_9O_8)H_2N$, or similarly with aniline, to obtain the corresponding anilide: a very strong corroboration is found in the tendency of the acid to condensation when the diacid appears to contain the elements of—

$$C_{56}H_{17}O_{16}.O.HO \text{ or } \begin{Bmatrix}C_{28}H_8O_8\\C_{28}H_9O_8\end{Bmatrix} = (C_{56}H_{17}O_{16}).$$

Alizarin and purpurin, in all probability, have a similar glucoside origin, but the derivation in that sense is not so clearly made out. Perkin has obtained a triacetyl purpurin which contains the following elements:—

Purpurin	+ 3 Acetic acid	− 6HO =	
$C_{28}H_7O_8.O.HO$	$C_4H_3O_2.O.HO$	$C_{28}H_4O_8$ $C_4H_3O_2\}$ $C_4H_3O_2\}$ $C_4H_3O_2\}$	$C_{40}H_{31}O_{14}$ O.HO,

and a similar tribenzoyl compound, and speaks of a similar diacetyl alizarin: I thence project that—

Alizarin	+ 2 Acetic acid	− 4HO	
$C_{28}H_7O_6.O.HO$		$C_{28}H_6O_6$ $C_4H_3O_2\}$ $C_4H_3O_2\}$	$C_{36}H_{31}O_{14}$ O.HO,

and I subsequently find that analysis gives $C_{36}H_{32}O_{12}$!

Why not, therefore, obtain the amides, anilides, or sulpho-salts of these bodies, and thus determine for ever whether these bodies are mono- or bibasic?

The presumption is irresistible that the alizarin amide would contain $C_{28}H_7O_6,H_2N$, and similarly with purpurin. That such would easily and almost certainly result is evidenced by a wide range of collateral facts connected with the following hydrocarbons:—

Benzol Series.	Naphthol Series.	Anthracen Series.
$C_{12}H_5.H$	$C_{20}H_7.H$	$C_{28}H_7.H$
$C_{12}H_5.O.HO$	$C_{20}H_7.O.HO$	$C_{28}H_7.O.HO$
$(C_{12}H_5O_2)O.HO$	$(C_{20}H_7O_2)O.HO$	$(C_{28}H_7O_2)O.HO$
$C_{12}H_5O_4.O.HO$	$C_{20}H_7O_4.O.HO$	$C_{28}H_7O_4.O.HO$
	$C_{20}H_7O_6.O.HO$	$C_{28}H_7O_6.O.HO$

The No. 1 of the anthracen series is not anthracen, and it is more usual in lists of this character to lead off with the hydrocarbon of the next higher series, as if it were at all necessary to eliminate 2H before inserting the 2O. This first step, however, in the oxy-progression is almost wholly ignored, and a quinon body, No. 3, is supposed to result from the elimination of H_2 and their replacement by the divalent group (O_2), &c.

Such lists can be projected in several ways, according to the object in view, and we offer the following:—(See Table below).

No. 1 gives the hydrides of ethyl, phenyl, toluyl, &c., and many intermediates might be added, as also chrysen and others beyond.

No. 2 gives aldehyd, quinon aldehyd, benzoic aldehyd, and the aldehyds of naphthaquinon and anthraquinon. That a similarity of type and general properties may here subsist all through there can be no question.

No. 3 gives acetic, collic, and benzoic acids, naphthaquinon, and anthraquinon. With a greater knowledge of minutiæ than we at all pretend to in this superficial survey, it is quite feasible that the terms collic and benzoic acid, as associated with the two quinons, would have to be replaced by quinon and salicylol, or some other isomers. We use these terms merely as representative of their types, and claim for the series all the regularity and interest attaching to No. 2.

No. 4 gives glycollic acid, an oxy-quinon body, represented by chloranilic acid, oxy-benzoic acid, oxy-naphthaquinon, and oxy-anthraquinon.

No. 5 gives glyoxylic acid, dioxy-benzoic acid, naphtharazin, and lizaric acid or alizarin.

No. 6 gives gallic acid, trioxo-naphthaquinon, and purpurin.

No. 7 gives oxy-gallic acid, tetraoxy-naphthaquinon, and oxy-purpurin or rufiopin.

Now, why is it that some of these isomers are regarded as comparatively neutral or aldehydic bodies, while others of the same composition are more definitely acid? Many have little hesitation in responding to this enquiry; but it is discouraging to observe how variously the atoms are arranged, according to the particular views entertained. Our position is one of far less pretension, and if we greatly extend the "hydrate" type it is only to express or classify a very wide series of relationship.

There are two directions in which we should look for isomeric differences of individual properties:—

(1.) A difference in the constitution of the radical: thus benzoic acid and salicylic aldehyd may both conform to certain general reactions, and so far establish their equal claim to the type $C_{14}H_5O_2,O.HO$, or any other which may better represent the generic similarity of those reactions. It is a matter of almost absolute knowledge that such radicals can have a different genesis, or can be built up of different materials, yet retaining the same proportion of constituent atoms as a whole.

	Ethyl.	Phenyl.	Toluyl.	Naphthyl.	Anthracyl.
1.	$C_4H_5.H$	$C_{12}H_5.H$	$C_{14}H_7.H$	$C_{20}H_7.H$	$C_{28}H_9.H$
2.	$C_4H_3.O.HO$	$C_{12}H_3.O.HO$	$C_{14}H_5.O.HO$	$C_{20}H_5.O.HO$	$C_{28}H_7.O.HO$
3.	$C_4H_3O_2.O.HO$	$C_{12}H_3O_2.O.HO$	$C_{14}H_5O_2.O.HO$	$C_{20}H_5O_2.O.HO$	$C_{28}H_7O_2.O.HO$
4.	$C_4H_3O_4.O.HO$	$C_{12}H_3O_4.O.HO$	$C_{14}H_5O_4.O.HO$	$C_{20}H_5O_4.O.HO$	$C_{28}H_7O_4.O.HO$
5.	$C_4H_3O_6.O.HO$	$C_{12}H_3O_6.O.HO(?)$	$C_{14}H_5O_6.O.HO$	$C_{20}H_5O_6.O.HO$	$C_{28}H_7O_6.O.HO$
6.			$C_{14}H_5O_8.O.HO$	$C_{20}H_5O_8.O.HO$	$C_{28}H_7O_8.O.HO$
7.			$C_{14}H_5O_{10}.O.HO$	$C_{20}H_5O_{10},O.HO$	$C_{28}H_7O_{10}.O.HO$

(2.) There may be a difference of type, which further knowledge may be able to exemplify, and hence the confusion and mistake we have pointed out between chloracetic acid and chloride of glycolyl.

When chemists use the *true* chloracetic acid they get a real acetyl substitution; when they use the isomer, still calling it by the same name, and not perceiving the distinction, they obtain a glycolyl substitution!

Now as whenever we have a chloride we may almost certainly have a hydride,—therefore, replacing the Cl by H, we have as a typical case the two isomers in question:—

Acetic acid .. .. $(C_4H_3O_2)O.HO = C_4H_4O_4$
Hydride of glycolyl $(C_4H_3O_4)H = C_4H_4O_4$.

And it is more than probable that in this way many of these bodies may vary isomerically—first, in their radicals, and secondly, in their types.

(To be continued.)

ON THE NECESSITY FOR ORGANISATION AMONGST CHEMISTS, FOR THE PURPOSE OF ENHANCING THEIR PROFESSIONAL STATUS.

By C. R. ALDER WRIGHT, D.Sc.

The remarks which have from time to time appeared in the Chemical News, calling attention to the daily encroachments made on the province of the professional chemist by medical men, engineers, and members of other professions, and to the numerous disabilities and inconveniences to which chemists are subjected for want of a proper mutual organisation whereby their status—in the eyes of the public generally—may be properly fixed, appear to be the expression of a very general feeling that, unless some steps are speedily taken to ensure that all persons who profess to be analytical and consulting chemists are duly trained and properly qualified for such positions, professional chemistry will soon become an occupation of such low standing in the eyes of the public that few properly educated men will embrace it as a profession; and thus a great injury will be inflicted on British chemical science, inasmuch as, under the present order of things, a scientific man devoted to chemistry can only maintain himself by combining with his investigation-work more or less of tuitional or of business chemistry—a state of matters to be deplored, but which does not seem likely to be altered at present in this country.

At the present moment professional chemical work (apart from science teaching and lecturing, and from scientific research) is carried on by two classes of practitioners, viz., by men who have spent years of time and considerable sums of money in perfecting their technical as well as scientific knowledge, so as to become qualified to act as thorough analytical and consulting chemists: of these many combine tuitional with professional chemistry, holding chairs and lectureships in the different schools and colleges of the country, whilst a considerable proportion manage to snatch some time from the hard work of their multifarious bread-winning duties for the carrying out of original researches; secondly, by a much less completely trained and specially qualified class of men—in many cases belonging rather to the artisan than to the highly-educated classes: frequently such pseudo-chemists commence as subordinate assistants and bottle-washers in the laboratories of chemical works and factories, in which places they may certainly acquire some knowledge of the more or less rough-and-ready testing processes in use for the examination of a few materials and products, but necessarily do not obtain the thorough systematic instruction necessary to enable them to examine with accuracy the innumerable substances that may be brought to them in general practice. Sometimes they are science teachers who, being possessed of a small smattering of laboratory knowledge, endeavour to supplement their by no means too great earnings as teachers, by undertaking professional chemical work, for which as a rule their experience and skill are scarcely sufficient. Occasionally they are medical men possessing only the small modicum of chemical knowledge gained during their studies in the medical school, and often wholly innocent of any notion whatever how general quantitative work should be conducted, although they may have picked up some acquaintance with the methods to be adopted in the examination of some few articles of food, of water, or air, &c.

These semi-chemists inflict a double injury on the legitimate practitioners. In the first place, although they continue to go on tolerably smoothly when routine analyses or work of ordinary occurrence is in hand, yet as soon as anything out of the common run crops up, or if a quantitative determination requiring more than ordinary skill is required, they are at sea: in many cases they get out of the difficulty by sending the analysis on to some one more skilled than themselves; in others, they make the attempt, and produce a result which often is satisfactory enough to the unfortunate client, but which is, as likely as not, perfectly fallacious: occasionally their results are checked by more competent chemists, when woeful discrepancies come to light. Cases of this sort are familiar to nearly every chemist, but the unfortunate result is that the general public—being unable to decide between the qualified man and the semi-educated empiric—throws discredit on both, and on the chemical profession generally. In the second place, these quasi-chemists, not having to recoup themselves for the time and money spent in acquiring a thorough knowledge of their profession, are frequently willing to do work for fees absurdly low: the general public finding that Mr. Smith or Jones, F.C.S., will do analyses at a certain figure, expects the competent man to do the same; and if the latter does not come down to the fees for which his bastard professional brother will work, he loses his clients and his income altogether.

It does not require demonstration that if any one professes to do analytical work for fees which cannot possibly remunerate a properly qualified man for the expense of his education, he must slur over the work in some way: accurate methods—requiring time, labour, and above all skill—are discarded in favour of rough and rapid tests; the work is done at race-horse speed, and without due care and attention; it is even alleged that occasionally the work is not done at all, the results being simply the offspring of the analyst's imagination! The sad results of the rapid increase in the number of imperfectly skilled persons attempting to practise as chemists are a rapidly growing distrust of chemists generally and their analyses in the eyes of the public, and a consequent diminution in the status of the professional chemist, together with an increasing difficulty in making an income out of chemistry as a profession by thoroughly skilled persons: this means, in many cases, that time which would otherwise be devoted to valuable scientific researches must instead be given to bread-winning. Moreover, the general public is frequently defrauded by being supplied with incorrect analyses and fallacious tests.

A good illustration of the lowness of the position chemists now occupy in the eyes of the public, as compared with members of other professions, is afforded by the amounts of the salaries offered to Public Analysts as compared with those of the Medical Officers of Health in the same districts. Frequently the Public Analyst is paid at a lower rate than a Nuisance Inspector, Surveyor of Roads, or even the Parish Beadle: the wonder is, accordingly, not that the best known names in the chemical world are—for the most part—conspicuous by their absence from the list of Public Analysts, but rather that there should be really a considerable percentage of skilled chemists amongst them. The bare fact that so many thoroughly trained chemists are willing to take posts as a rule much underpaid is a sufficient proof of the difficulty experienced in making a decent living out of professional chemistry.

The remedy which naturally suggests itself for these injuries to the public, and these and various other grievances of professional chemists, is that these latter should unite together, forming an *Association* or *Guild*, and that they should obtain a Charter enabling them to do as is done in what is virtually the Guild of Medical and Surgical Practitioners; *i.e.*, to *grant licenses to practise to duly qualified persons only*. The possession of the licentiateship of the Guild would then be a fair guarantee to the public of the efficiency of the owner; whilst non-licentiated practitioners should be debarred from the power of enforcing, by law, payment for the work which they are presumably incompetent to perform (just as in the medical profession): neither the certificate of analysis nor the evidence of experts, as such, should be admissible in any court of law in the United Kingdom. Probably a special Act would be requisite to enforce these conditions.

The complaints now frequently made—and in some cases with but too much truth—of the incompetence of many so-called chemists and analysts, and the slovenliness and unreliability of much of their work, would in all probability cease altogether when such an Association was once formed—especially when it was known that for proved professional misconduct a licentiate's name would be erased from the rolls of the Guild (much as a Solicitor can be struck off the Rolls, or as a Counsel may be disbarred, or a theological practitioner inhibited from preaching, or unfrocked). A most salutary check on unconscientious work would be established if any client who found analyses of the same sample, by different licentiates, to differ unjustifiably, should have the right of bringing the matter before the Council of the Guild, who should then appoint a referee to examine into the case, the expenses of so doing to be paid by that analyst who should be found to be in the wrong.

When once fairly inaugurated, the Guild might perhaps advantageously consider the propriety of fixing a tariff of fees for ordinary commercial analyses, &c., and of promulgating official methods of analysis. Of course the formation of such a tariff of fees would in no way interfere with the right of each specialist or man distinguished in science to charge his own higher fees for reference cases or other special services; whilst no interference need necessarily be thus caused with the present system of analysts contracting with manufacturers, &c., for series of analyses and valuations of their products for the purpose of guiding and controlling their manufactures. Each certificate of analysis by which goods are bought and sold, on which an action or a prosecution is based, &c., might, however, be advantageously paid for according to a fixed tariff.

It is at once noticeable that an organisation for business purposes amongst chemists bears no very intimate relationship either to purely scientific research or to science teaching. A man may be an admirable theoretician, a good lecturer or teacher, without being more than an indifferent analyst, whilst he may be wholly unskilled in manufacturing and business chemical details; or conversely, a man be a thorough chemical engineer, an admirable adviser in reference to certain manufactures that he has specially studied, &c., without being able to teach theoretical chemistry, or without being capable of conducting a purely scientific research. It will, however, be generally conceded that the man who can originate, plan out, and work out to a successful conclusion, an experimental research, either in pure or in applied chemistry, must possess the analytical knowledge and manipulative skill requisite in an analyst, whilst his mental capacity must be at least equal to the demands likely to be made upon it whilst exercising the vocation of a consulting chemist.

Manifestly, too, such an organisation of professional chemists would occupy ground quite different from that taken up by the Chemical Society; the first would have reference to chemistry solely as a *business*, as a means of livelihood; whilst the second looks on chemistry only as a *science*; only duly qualified persons would have the privilege of being registered on the rolls of the Guild; whilst, as is well known, any one who takes an interest in chemical science, whether connected with it as an experimental discoverer, as a druggist, science teacher or lecturer, or as a professional chemist, or whether unconnected altogether with chemistry in his occupation but taking an amateur interest therein, is ordinarily admitted to the Fellowship of the Chemical Society, provided (as in a recent case in point) there is no special reason to the contrary; and there is a great deal to be said in favour of this mode of proceeding.

Just as a man may be L.S.A. or M.R.C.P., and may practise medicine as a means of support, and may further by researches (say in pure physiology) acquire world-wide fame; so a consulting chemist might be a licentiate of the proposed Guild, maintaining himself by professional chemistry, and might also by his investigations in pure chemistry reach the highest pinnacle of distinction. The two connections in which physiology and abstract chemistry would stand to the two individuals respectively would have to each other only this indirect relationship, that the man whose reputation for scientific work is great is for that reason not unlikely to have lucrative private practice flowing in to him, although this result would not necessarily be brought about. The Chemical Society is associated with the one kind of connection, the proposed Guild with the other.

The question immediately arises, in what way can the practical difficulties be overcome that lie in the way of sorting the present race of chemists and pseudo chemists into these two classes, and of enforcing on the latter of the acquisition of more skill and special training than they at present possess before admitting them to the licentiateship? Possibly something like the following scheme might be practicable if only the chemists of higher standing would be willing to exert themselves a little for the purpose of bringing about the result so much to be desired, viz., the exaltation of their professional status by excluding incompetent members. A general meeting of chemical practitioners might be convened at which a committee of selection might be appointed to draw up a preliminary list of professional chemists whose status as such, or whose published investigations, demonstrate their fitness for immediate registration as duly qualified chemists; gentlemen desirous of such registration being invited by advertisement or otherwise to fill up forms stating the grounds on which they base their claim for registration, such as the place and duration of their studies, the length of time in which they have been engaged in professional pursuits, and the character of these, the nature of their published researches, &c., &c. At another general meeting this list might be amended and adopted, and from its contents a constructive committee appointed to prepare draughts of the charter to be applied for, and of the bye-laws and rules and regulations of the Guild. Finally, at another meeting these draughts might be discussed, amended, and adoped.

As regards the admission to the licentiateship of the Guild, when this is once fairly inaugurated, all candidates unable to satisfy the original committee of their fitness for immediate registration and all subsequent applicants might be subjected to examinations of such a character as to test their fitness for the licentiateship, *practical quantitative work forming an essential part of such an examination*. Whether two successive examinations (like the Primary and Final of the College of Surgeons) should ultimately be adopted, and whether proficiency up to a certain standard in the subjects of ordinary English education, elementary mathematics, physics, French, or German, &c., should be insisted on as necessary qualifications for one aspiring to become a member of a recognised profession, and similar questions, are points to be decided by the constructive committee of the Guild. If two successive examinations were thought desirable, manifestly those who had passed the first examination would

have advantages over others who had not done so in competitions for assistantships and the like; whilst on the other hand there would be no reason why non-qualified and non-examined assistants should not be engaged in commercial and manufacturing laboratories for the purpose of doing routine mechanical work (*e.g.*, filtrations) just as at present; only such would be unable to give valid certificates of analysis for brokers' purposes or for legal proceedings until they had, by passing the examinations, shown that they had qualified themselves for promotion to the higher grades.

A most important question connected with any proposition for organisation amongst chemists is, in what way are the necessary preliminary expenses and the cost of maintenance of the Guild to be defrayed? As regards the first, by charging a registration fee (say five guineas) to each chemist who is licentiated by the Guild from its very commencement, a sum would probably be obtained sufficient to meet the expenses upon the obtaining of a charter, &c.; subsequently, examination fees might be charged in addition to all requiring examination before admission, and if necessary an annual subscription required from each licentiate; possibly it might be practicable to collect a revenue by requiring that each licentiate shall affix to every certificate of analysis given by him for the purpose of buying or selling goods or of being made evidence in a court of law, &c., a stamp (value say one shilling) to be issued by the Guild; no certificate to be admissible without such stamp being affixed, or the value of the stamp might be a fixed percentage on the analytical fee. Such a mode of collecting revenue finds its parallel in the legal organisation of this country.

The scheme thus roughly sketched out is not in any way put forward as a perfect one; but if by drawing out the ideas of chemists and promoting discussion on the subject, it should help to pave the way for a more suitable plan of organisation, its object will have been fulfilled.

PROCEEDINGS OF SOCIETIES.

PHYSICAL SOCIETY.

January 15th, 1876.

Professor Gladstone, F.R.S., President, in the Chair.

The following candidates were elected Members of the Society:—Sir David Lionel Salomons, Bart., Arthur R. Granville, and Capt. Abney, R.E.

Prof. Woodward, of the Midland Institute, Birmingham, exhibited and described a novel form of apparatus for showing either the longitudinal motion of sound-waves, or the transverse vibration of those of light. It consists, essentially, of a series of balls suspended in a horizontal line by strings. These balls rest against a series of transverse equidistant partitions in a wedge-shaped horizontal trough, which can be raised and depressed parallel to itself. If, while a ball is placed against each partition, the frame be drawn aside in the plane in which the balls hang, and then slowly depressed horizontally, the balls will be successively liberated, the order in which this takes place being regulated by the heights of the partitions. As these gradually increase from one end to the other, the appearance presented is that of a series of condensations and rarefactions, as in the ordinary acoustic wave. If the frame be drawn aside, parallel to itself prior to depressing it, the balls will rest against one side of the trough, and can be liberated in succession, causing them to oscillate in planes parallel to themselves. By this means a vibration of the particles is set up, resembling that of polarised light.

Prof. Guthrie suggested that Mr. Woodward should devise a similar apparatus for exhibiting stationary waves.

Prof. Woodward promised to remember the suggestion, and stated that he had endeavoured to adapt the apparatus to circular and elliptic wave motion, but experienced considerable difficulty.

Mr. Lockyer then made a communication on "*Some Recent Methods of Spectroscopy*." At the outset he mentioned that he brought these processes forward in the hope that others present might be induced to take up some branch of the work. The first subject of which he treated was the photographing of the solar and metallic spectra. Mr. Rutherford, of New York, who has produced some of the finest photographs of spectra extant, has shown that to obtain clear photographs the smallest possible portion of the surface of the prism should be employed. An excellent method for ensuring this is to focus the light on the slit by means of a common opera-glass (as large as possible), which should reduce the beam of parallel rays incident on the first prism to not more than a quarter of an inch in diameter. Mr. Lockyer exhibited the 4-prism spectroscope employed by himself, to which a camera about 4 feet long is adapted. By this apparatus a large series of comparisons has been obtained between the sun and the metals, the slit employed being provided with five slides, so that the spectra can be accurately arranged side by side. It is advisable always to observe the image of the electric arc when comparing the spectra of metals with that of the sun rather than direct light. It is also found very advantageous to place the poles of the lamp at right angles to the slit, as by this means the spectra are more sharply defined than when observed in the ordinary manner; and, further, the appearances presented by the spectrum of a metal are comparable with those observed in the solar spectrum during, say, a magnesium storm. In the photograph comparing the spectra of aluminium and calcium it is noticeable that certain lines are common to the two, but those which are thick in the aluminium spectrum are thin in that of calcium, and *vice versa*. This depends on the quantities of impurity present. It has thus been shown that there are no proper coincident lines in the spectra of any two simple substances, and that there is no substance spectroscopically pure. The relation between the lengths of the non-continuous lines, and the amounts of metals employed to produce the spectrum, convinced Mr. Lockyer that it would be possible to employ the spectroscope for quantitative analysis. The earlier experiments in this direction were then referred to, as well as those in which Mr. Lockyer has recently been engaged in conjunction with Mr. W. Chandler Roberts, of the Royal Mint, with a view to ascertain how far it is possible to detect small differences of composition in gold-copper alloys, such as that used for the coinage. The method employed consists in measuring, by means of a micrometer in the eye-piece of a 4-prism spectroscope, the relative lengths of certain gold and copper lines when the image of an induction-coil spark passing from the alloy under examination is focussed on the slit. Although the results obtained have not been uniformly comparable, and therefore reliable, it is nevertheless certain that a difference of composition as minute as the 1-10,000th part is recognisable by this means. Another branch of spectroscopic research, to which Mr. Lockyer alluded, was the study of the absorption-spectra of metals when they are not subjected to so violent an action as that of the electric arc. Observations of this nature have been made at low temperatures by Roscoe and Schuster and by Mr. Lockyer, and at the highest temperatures produced by the oxy-hydrogen blowpipe by the latter in conjunction with Mr. Roberts. These experiments, which have been fully described in the *Proceedings of the Royal Society*, show that the absorption-spectra of metals may be divided into five classes, which, for any particular metal, depend on the amount of heat applied. They also show that in passing from the liquid to the most perfect gaseous state, vapours are composed of molecules of different orders of complexity; and, second, this complexity is diminished by the dissociating action of heat, each molecular simplification being marked by a distinctive spectrum.

The President enquired whether the indium line, to

which Mr. Lockyer had referred, and by means of which the metal was originally discovered, was absolutely identical with the hydrogen line.

Prof. McLEOD asked if Mr. Lockyer had found that the incandescence of the air made any difference in the character of the spectra, and drew attention to the advantage of a small lens placed in front of the slit.

Mr. WOODWARD enquired whether any mechanical means were adopted for ensuring that the lamp gave a constant light while in the horizontal position.

Dr. GUTHRIE referred to the spectrum observed when light traverses the vapours resulting from the action of copper on nitric acid. He wished to know whether the number of bands observed stands in any relation to the number of possible oxides of nitrogen at a given temperature. Or must one oxide of nitrogen be considered as being capable, at that temperature, of giving bright and dark bands according to the way in which the light acts on it.

Mr. LOCKYER, in reply to the President's question, said that, so far, no difference has been observed between the refrangibility of the hydrogen line and that of indium. He is anxious to ascertain whether any occluded hydrogen exists in the metal. Little or nothing is known as to the subject referred to in Dr. Guthrie's question. The use of the electric lamp eliminates all difficulty with reference to air lines, as its "atom-shaking" power is not sufficient to break into lines the spectra of nitrogen and oxygen. It was found necessary to make all the adjustments referred to by Mr. Woodward entirely by hand.

CORRESPONDENCE.

NAPIER'S MANUAL OF DYEING.

To the Editor of the Chemical News.

SIR,—It is now over twenty years since the old edition of Napier's "Manual of Dyeing" was published, it bearing date 1853. If any practical dyer were asked if any change had taken place in the dye-house in that time I can imagine the answer would be "Yes. Equal to almost a revolution. Many colours are obtained by quite different methods now, and many more are new altogether." Allowing, then, that such changes have taken place, we young dyers naturally look to those who profess to be leaders to give us information respecting them. For though the old processes may still dye a given shade, yet if more modern ones have been adopted by the trade we expect to be informed of them, because they are to us of much more importance than the old ones. Likewise in the chemical department; it is all very well to know the methods in use twenty or thirty years ago, but it is much more useful to know the processes in use at present.

I have said this much because I think our author has failed in this very important, and I may say essential, point. Especially is this the case in his receipts, many of which are both bad and costly as compared with those in use at present.

The first thing, however, that attracts my attention is a statement on page 11 to the following effect, viz.,—"The following are the effects upon a few of the more ordinary colours when exposed to the sun for a *few days*, often in a *few hours*:

Dark indigo-blue becomes light.
Aniline-blue becomes light gray.
Yellow by fustic becomes straw-colour.
Yellow by chrome becomes greenish brown.
Red by madder becomes lighter.
Red by cochineal becomes paler.
Red by safflower becomes white, yellow tint.
Red by magenta becomes very light.
Green by indigo and chrome becomes light and dirty.
Green by vegetable yellow becomes dull and pale.
Black by logwood becomes brown.

When these colours are exposed wet the effects are much sooner produced."

If these effects were produced very much sooner few people except the dyers would see the colours at all.

Now that many of the changes do take place in time I readily admit; but, for the sake of my trade, I deny that they take place in a few hours; for I can scarcely think that a good dark indigo-blue overcoat put on in the morning would become light blue by the evening, even if exposed wet to the sun. And, again, with respect to blacks; it entirely depends upon the mordant used as to what changes will take place. For instance, it is well known that if the mordant be bi-chrome the change will be to a greenish hue, and not brown; but this the author never mentions. Now I notice that this is an addition to the new work, and not contained in the old edition. How a practical dyer could make such a statement is strange indeed. Speaking on oxygen, I find the following (page 31):—

"Dyed fabrics, whether wet or dry, suspended in this gas are not affected—a fact for the dyer to bear in mind when he is identifying this gas with chlorine."

Am I here to understand that oxygen plays no part in dyeing. There is a list of chemical actions, but the actions in dyeing are none of them included in that list, therefore the natural inference must be—oxygen has no action in dyeing. Could anyone get much further from the mark, and is it not calculated to lead anyone obtaining his information from this book only completely astray? The other part—viz., identifying O with Cl—I cannot understand, because I think every dyer who had learnt sufficient chemistry to know that these two elements existed at all would be able to distinguish, or at least have learnt at the same time their different properties.

It is stated (page 65) that alkaline lyes for steeping goods before bleaching ought not to be hotter than blood-heat, because if oil be upon the goods it will not be saponified—a strange statement if we consider the manufacture of soap: and I should imagine that whatever the ulterior action may be, saponification to a certain extent will be sure to take place.

It is stated (page 94) that grease and oil spots are not removed by carbonated alkalies, and it is therefore necessary to causticise them before using. There is no mention made whether for cotton or woollen fibre, and therefore anyone might suppose from this that the use of caustic alkalies was necessary for woollen fibre. Imagine a person gaining the whole of his information from this work, and then trying his hand upon some woollens goods. He would probably remember the experiment if he tried it upon a moderately large scale.

Speaking on alum, and the use of the alkalies in its manufacture, the following is given (page 119):—"AmHO alum is expensive, and possesses no corresponding advantage over the ordinary article." Compare this with "Crookes," page 275, where the following is given:—"The greater part of the alum now met with in commerce is ammonia alum. The ammonia alum is slightly more advantageous in strength." Compare also tome ii., page 205, Schützenberger's "Matières Colorantes":—"La fabrication de l'alum ammoniacal a presque partout remplacé celle de l'alum potassique, pour raisons d'économie." Which statements am I to believe? This manual has been published since either of the others quoted, and by a F.C.S. I am inclined, however, to believe the two quoted, more especially as I find all the alum I get for use is ammonia alum.

I find the following on green colours (page 209):—"Green is well known to be a compound colour produced by yellow and blue, and is *always* produced upon cloth by dyeing it first the one colour and then the other: it is not always the yellow that is dyed first, but sometimes the blue." On turning to the receipts at the end of the book I there find only two out of seven in which the blue and yellow are put on at two separate operations. Now either the above statement is wrong or the receipts are wrong,

which is it? If I have a green to dye this week, and to decide which will be best, to put first the one colour and then the other, or both together, I appeal to this "Manual," how am I to be guided?

Treating on galls (page 213), the analysis of Sir H. Davy is given, and 26 per cent of tannin is there said to be contained in the best galls. There is no mention about this being low—nothing to hinder the reader from taking this as a correct analysis. On the next page a method is given by which 35 to 40 per cent can be extracted; but the query is, How can 40 per cent be obtained from an article in which the best only contains 26 per cent? If the 26 per cent is too low according to better methods of analysis why give it, and say nothing about it if the other is too high, the same? But on turning to page 219 I find it given at 65 per cent.

Under the head Valonia nuts (page 227) I find the Scotch dyers are still behind in silk dyeing; in fact, just as they were twenty-one years ago. I hope that we Yorkshire chaps will be able to get up to them if they stand still a little longer.

On the same page I find divi-divi has been tried as a dye in place of sumach, but is not much used. Compare page 63 of Slater's "Manual of Dye Wares":—"Divi-divi is one of the most important of the class of astringents—much richer in tannin than sumach." Again, in Crookes's "Handbook of Dyeing," page 500, I find:—"It is one of the most important astringents in the market, and it is very largely used in producing a black upon cotton warps and mixed goods."

Again, on same page, I am informed that the reactions of myrabolans are similar to those of sumach, but of less value. On comparing page 12 of Slater's "Manual of Dye Wares" I read:—"Being much cheaper than gall and stronger than sumach, they are rapidly superseding both these wares, except in a few special cases." This manual is dated 1870. On comparing Crookes's "Handbook of Dyeing," dated 1874, I read:—"Myrabolans being cheaper than gall, and stronger than sumach, have to a very great extent superseded both." Now what am I to understand by these statements. I seldom get out of my native town, to the newest books I therefore look for information, and in this case I find it in direct contradiction to what was published in 1870 and in 1874, and exactly like what was published in 1853, over twenty years ago. Now, as I have to work hard for my guineas, I protest against such things being palmed off under the guise of "revised and re-written."

Page 229 commences an article on indigo. This extends over about forty pages, and the only new matter that I find in the whole article is a part of page 268, and this is mostly relating to the zinc-vat, which the author says was introduced on the Continent a few years ago. I suppose he is here alluding to the patent of MM. Cohen; if so, however, the difference of the two receipts given is rather singular. In an article in the *Moniteur de la Teinture* upon that method I find Cohen gives the following as fair working proportions, viz.:—Zinc powder, 1·4 parts; quick-lime, 6 parts; and indigo, 1 part. In Napier's "Manual" I find the following:—Iron filings, 30 parts; zinc, 75 parts; slaked lime. 56; and indigo, 100, to set a vat of ordinary size. Just fancy 100 lbs. of indigo for setting a vat of ordinary size. I note also Cohen gives 6 lime to 1 indigo; the "Manual" gives 56 lime to 100 indigo, rather over ½ per cent lime to 1 indigo. There is not one word said of the new method of Schützenberger, and Lalande's process now in use both in England and on the Continent, which surely is a very grave omission in a work that professes to be eminently practical. Would it not have been better to have left out some of the old matter and put in some account of modern proceedings.

Treating upon OH_2 (page 350), I am informed that the amount of hardness of water may be known by the milkiness given with soap. Query, How much milkiness equals, say, 10 degrees of hardness? Seeing that the author professes to teach us chemistry, he might have explained Clarke's process, water being of so much importance to us.

On page 354 it is stated—Yellow boiled with soap, if fustic be the colouring matter, it is removed. On the same page, a little further down, I find as follows:—"One portion is treated with boiling soap solution. The colour becomes very dark; it is fustic." No explanation as to whether they are on different fibres or not. Which must I believe? they are directly opposite to each other.

Again, on reds by Brazil woods, by which I suppose is meant the red-wood generally, the following is given:—"Reds by Brazil woods are mostly removed by a sour made with vitriol." Further on I find:—"Treated with sulphuric acid they become cherry-red." So vitriol *removes* Brazil-wood reds, and sulphuric acid *makes them cherry-red*. No mention is made if on different fibre, so it must be as read, only which is the right one?

The whole of the receipts, with very few exceptions, are exact reprints from the old edition; and so far as the woollen portion of them goes, very many, indeed most of them, are not worth the paper they are written on for a practical dyer at this day. Receipt No. 221: we are told to take one pound cochineal paste. No. 49, to dye crimson. On looking at No. 49 I find a method of preparing safflower for dyeing cotton; and I would ask how many dyers use sumach for dyeing scarlet, as is given in 223? In 244 we are instructed to boil in soda-ash. Does Napier know the effects of boiling ash on wool? And, again, what dyer would dye a union piece as No. 211 and then 72, and if he did what sort of black would he get? Does the author know know the effects of lime-water upon wool?

Taking the book as a whole it is [illegible] indeed. In fact, the whole of the matter, or nearly so, which is of any value to the dyer is contained in the old edition. There is not, so far as I have seen, a single new method for the estimation of the dye wares, leaving us to infer either that there was nothing new in that line, or else that the old methods are still the best.

The preface to the present edition commences as follows:—"Since the time when the Manual was first published many and important changes have taken place both inside and outside the dye-house." Yet throughout the whole work there is not one new engraving: those for chlorimetry, alkalimetry, and all others, are exactly the same as in the old edition, and I am sure there are apparatus much better adapted for that kind of work than those sketched in this work; but they are not even mentioned, much less engraved—a very important omission on the part of an author, the chief merit of whose work consists in his supposed practical knowledge of the wants of the dyer: I find also many repetitions. For instance, on p. 158, I find under the head "Tin" a number of receipts for making spirits; same again at page 197; and then again on pages 345-6. Speaking of iron (pp. 129 to 139) there is the method given of making all the common salts of iron. They are again given on pages 342 and 343. It is the same with copper and alumina salts, and again with the preparations of indigo. Now, why there should be all this repetition I cannot tell; I am sure there is much valuable matter omitted which might have occupied the space thus taken up. Had the book been advertised simply as another edition of the old Manual, without any revision, those who had the old one would have known; but to be advertised as revised and re-written, and then to find it is little more than a reprint, does not exactly suit.—I am, &c.,

J. B. WILKINSON.

SODA TESTS.

To the Editor of the Chemical News.

SIR,—Permit us to avail ourselves of Mr. Hall's courteous mention of our name in the CHEMICAL NEWS (vol. xxxiii., page 8) to subjoin a few remarks on our method of testing soda-ash and reporting the results, for the information

both of producers and consumers of alkali, as we find many erroneous reports and beliefs are in circulation on this subject.

In the first place, we still retain 32 as the commercial equivalent of soda, in accordance with the custom of trade, and also in accordance with our custom since soda-ash was sold by test in London; we report the first place of decimals so far as 0·60; but should the sample exceed this we put it up to the full unit. Thus, with a sample of 50 to 51 per cent alkali which tests 50·10 to 50·60 per cent, we return the actual figures, and the buyer pays on 50 per cent; but when it tests 50·70 to 50·90 per cent we return such sample as 51 per cent, on which the buyer pays.

As the decimals of the unit are not recognised by the trade, the above old customary practice is a sound and good one, so long as this practice is retained, in preventing the advantage being always on the side of the buyer, who nevertheless retains, to a slight extent, the sound side by "the turn of the scale."

The foregoing statements may well evoke the questions, Why retain a standard, 32 for soda, which is well known and admitted to be in error? and, Why not buy and sell ash and caustic soda on a basis of units and tenths? as samples may now be easily and accurately tested within this limit. These questions are, however, trade questions, to be considered and determined by the producers and consumers as may seem good to them, for it is rightly their province to decide upon a change of standard and trade customs; but we may be permitted to add that should the trade think that the time has now come to rectify the standard, and deem it advisable to settle their accounts on the basis of units and tenths of an unit, and formally communicate this decision to us, we, for our part, shall most gladly obey such instructions, and from any given date issue our Alkali Certificates on the basis of 31=soda, and the determination of strength to one-tenth, *i.e.*, from 0·10 to 0·90. Neither buyer nor seller can or will be damnified by this change beyond the one-tenth, the turn of the scale the buyer now gets if a sample tests 0·60, as, all other conditions remaining the same, the buyer will obtain precisely the same amount of soda as before, only where he bought and paid for 100 lbs. soda he will buy and pay for 97 lbs. (96·57), and the seller will sell 97 lbs. soda where formerly he sold and delivered 100 lbs. of soda. But whilst no damage can accrue to either of the interested parties, we venture to maintain that much advantage would be gained by the assimilation of the commercial to the true and real standard for soda, if only by putting an end to all doubts and puzzlings on this subject, and closing the door to fraud, which will always exist whilst two standards are recognised.

A few words more as to the method of testing. Your correspondent, of the East London Soap Works, evidently credits us with not filtering our solution of soda-ash, a practice which we are aware obtains in some quarters, but one which he will take the writers' assurance has never been followed in this laboratory for more than a quarter of a century, nor he believes long previously, in the time of barilla, when soda-ash was almost unknown. A solution of the carefully-prepared sample is made in hot distilled water, filtered, and the filter thoroughly washed; the filtrate is then tested with weighed test acid, the volumetric mode having been disused for obvious reasons long before the time the writer speaks of. And this test having been confirmed by a re-test of a second portion, and we thus being sure of our correctness, the result is calculated, and our certificate of the sample issued, all of which he might have ascertained from us on 'Change or Mincing Lane, as we have never made any secret of our method. Moreover, if he will be so good as to calculate his own and our tests of the three samples of ash he quotes by the invoice standards of 32 and 31, he will find that whatever the producer may have to say he, as the consumer, has no ground of complaint, seeing that his test of 52·50 per cent (we have averaged the three samples), at soda =32 instead of 31, amounts to 54·20 per cent of alkali against our average of 53·30 per cent; which last, if we rectify by soda=31 instead of 32, amounts to but 51·60 per cent of alkali; so that, instead of a loss, we must congratulate him upon a positive seeming gain, in relying on our tests rather than his own as the basis of settlement.—We are, &c.,

E. F. Teschemacher and J. Denham Smith.

1, Highbury Park North, N.,
January 12, 1876.

SODA TESTS.

To the Editor of the Chemical News.

Sir,—I have read with interest the correspondence on soda tests, and think the consumers of soda-ash and caustic soda should stir themselves and get an end put to the present unsatisfactory system of testing. I think the Public Analysts have no business in reporting a sample higher or lower than it really is, but should report exactly what it tests. The system of using a commercial in place of the proper chemical equivalent for soda is a source of differences between chemists which should no longer be tolerated. Such a thing as being able to buy by London, Glasgow, or Newcastle tests, and sell at a profit by Liverpool test, as stated in Mr. Morrison's letter (Chemical News, vol. xxxiii., page 8), is a disgrace to the profession. If buyers would take the matter up in earnest, and insist on the test being based on the proper chemical equivalent, we should soon hear the last of high and low tests in soda.—I am, &c.,

Z.

ULTRAMARINE—ITS FORMATION DURING THE INCINERATION OF BREAD.

To the Editor of the Chemical News.

Sir,—Under the heading "Copper in Bread," in the Chemical News (vol. xxxiii., page 7), Dr. R. J. Atcherley merely shows that he has misread Dr. Edmunds's note as to the blue colouration which is described as sometimes occurring during the incineration of bread. In fact, Dr. Atcherley somewhat vigorously assails three propositions, neither of which was before your readers. A few weeks since Dr. Edmunds showed me some of the blue masses to which he refers: they were certainly very remarkable, and such as I had not before seen. On viewing them through the side of the tube containing them they were very suggestive of copper, of which, however, I understood that not a trace was present. I had no opportunity for further examination of the blue mass, and I was unable to offer any suggestion as to the probable composition. Should they prove to be ultramarine, the fact would be of interest, but doubtless their precise nature will be decided by some of your correspondents.—I am, &c.,

Charles H. Piesse.

303, Strand, London, January 11, 1876.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences. No. 25, December 20, 1875.

Formula for the Quantity of Magnetism Taken Away from a Magnet by the Contact of Iron, and for the Supporting Force.—M. J. Jamin.—This paper does not admit of abstraction. The author concludes that the supporting power, in case of a contact sufficiently large to restore the poles to their natural state, is inversely as the adhering surface.

New Researches on the Internal Magnetism of Magnets.—MM. Trève and Durassier.—The authors find that magnetism, far from being confined to the surface, penetrates to the very centre of the steel. They believe themselves authorised in concluding that the fact of the penetration of magnetism into the entire mass of a piece of homogeneous steel, magnetised to saturation, is a general fact; or that the magnetism, at first superficial, penetrates successively into the mass in proportion as the outer layers are dissolved away by an acid.

Researches on Eucalyptus Globulus.—M. F. A. de Hartzen.—Preliminary researches on the essence of *Eucalyptus*.

Action of Mineral Salts on the Crystallisation of Sugar, and Determination of their Coefficient.—M. P. Lagrange.—Contrary to the general opinion, among the salts contained in sugars, the chlorides are the least melassigenous, especially the chloride of sodium. Next follow the sulphates and carbonates, whilst the nitrates of potash and soda exert the most injurious action upon the crystallisation of sugar. If only chlorides and sulphates were present in crude sugars the coefficient 5 would be too high; but seven-tenths of the saline matter consists of nitrates of potash and soda, the respective coefficients of which are 3·5 and 6·5.

Action of Nitric Acid on the Phosphates and the Arseniates of Baryta and Lead.—M. E. Duvillier.—Nitric acid reacting upon the salts named decomposes them, liberating phosphoric and arsenic acids, and forming nitrates of baryta and lead.

Exchanges of Ammonia between Natural Waters and the Atmosphere.—M. Th. Schlœsing.—For the same tension of ammonia in the air the amount which dissolves in a natural water, up to the equilibrium of tension, decreases rapidly as the temperature rises. If two vessels of water, the one luke-warm and the other cold, contain each the same proportion of ammonia, the air which rests upon the former is much richer in ammonia than that which covers the latter. It is therefore to be presumed that the atmosphere between the tropics is richer than that of temperate and cold regions. The results furnished by sea-water and distilled water are nearly identical, the tension of the former, for the same percentage of ammonia, being somewhat greater.

Propagation of Heat in Rocks of Schistous Texture. E. Jannettaz.—Not suitable for abstraction.

Aniline-Black, with Reference to the Memoir of M. Coquillion.*—M. A. Rosenstiehl.—In the present state of science, whenever we wish to obtain aniline-black upon any tissue industrially, that is to say, economically and regularly, the simultaneous action of a chlorate, and of a metallic substance, is indispensable. Practice has selected copper for blacks to be developed at about 350° (?), and iron for those which have to be steamed (100°). If industrial conditions are not required, we may obtain aniline-black upon the tissue by the mere use of active oxygen without either chlorate or a metallic compound. In the same manner aniline-black may be produced without the tissue, and without the intervention of a metal, but with the aid of chlorates. The researches of M. Coquillion show that in this case also the same result may be reached without the chlorates. The fact observed by him is an elegant demonstration of the effect of active oxygen upon the salts of aniline.

Action of Ozone upon Animal Matter.—M. A. Boillot.—The author finds that meat may be preserved longer in ozonised air and ozonised oxygen than in ordinary air and oxygen.

TO CORRESPONDENTS.

S. Hall.—Messrs. Teschemacher and Denham Smith's letter renders the publication of yours unnecessary.

* *Comptes Rendus*, August 30, 1875.

MEETINGS FOR THE WEEK.

MONDAY, Jan. 24th.—Medical, 8.
— London Institution, 5.
— Royal Geographical, 8.30.
— Society of Arts, 8. Cantor Lectures. "Iron and Steel Manufacture," by W. Mattieu Williams, F.C.S.

TUESDAY, 25th.—Civil Engineers, 8.
— Royal Institution, 3. "On the Classification of the Vertebrated Animals," by Prof. Garrod.
— Society of Arts, 8. African Section. Opening Meeting.

WEDNESDAY, Jan. 26th.—Society of Arts, 8. "Iceland, its Scenery and its Rocks," by W. L. Watts (Illustrated by numerous Photographic Transparencies).

THURSDAY, 27th.—Royal, 8.30.
— Royal Institution, 3. "On the Chemistry of the Non-Metallic Elements," by Prof. Gladstone.
— Philosophical Club, 6.
— London Institution, 7.

FRIDAY, 28th.—Royal Institution, 9. "Border Territory between Animal and Vegetable Kingdoms," by Professor Huxley.
— Society of Arts, 8. "Industrial Pathology, or the Influence of Certain Injurious Occupations on Health and Life," by Dr. B. W. Richardson, F.R.S.
— Quekett Microscopical Club, 8.

SATURDAY, 29th.—Royal Institution, 3. "On Excavations in Asia Minor," by R. P. Pullan.
— Physical, 3.

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THE CHEMICAL NEWS.

VOL. XXXII. No. 844.

ON THE SPECTRUM OF GALLIUM.

By M. LECOQ DE BOISBAUDRAN.

I HAVE measured anew the the length of ray-waves of gallium in circumstances of exactitude which the feeble light of the spectrum obtained did not permit me to realise in my first determination. I have found strictly the same number for the principal ray; as for the less brilliant it is a little more refrangible than I estimated it at first. With chloride of gallium, relatively very concentrated, which I have recently submitted to the action of the electric spark, I have observed no other rays than the two following, and if others are found with still more concentrated solutions, they must be very feeble.

Position on the micrometer.—α. 193·72. λ. 417·0. Narrow, strong. Decidedly more brilliant in a spark of mean length than in a very short one.

Position on the micrometer.—β. 208·90. λ. 403·1. Narrow, well marked, but much weaker than α 193·72. Much brighter with a medium than with a short spark. Much more difficult to measure than α, but I do not think that the error of λ much exceeds 0·1. The ray α 417·0 is characteristic of gallium and is a very sensitive reaction.—*Comptes Rendus.*

ON THE NATURE AND REACTIONS OF SOME SILVER COMPOUNDS.

By SERGIUS KERN, St. Petersburg.

I. *Silver Sulphite* (Ag_2SO_3).

THIS salt was obtained in the form of a white precipitate resembling silver chloride, by mixing aqueous solutions of silver nitrate and sulphurous acid. During the preparation of this salt an excess of sulphurous acid must be avoided, because in this case the excess of the acid reduces the silver sulphite. The precipitate obtained is quickly filtered from the solution and dried over sulphuric acid. In order to obtain the silver sulphite in a more stable state I propose to pass through a concentrated solution of silver nitrate in alcohol a current of sulphurous acid; the precipitate of silver sulphite is filtered and dried.

This silver compound is easily decomposed by heat and water, when the latter is for some time in contact with the salt. Alcohol has no action on this salt. At 100° the decomposition of silver sulphite may be expressed by the following formula:—

$$2Ag_2SO_3 = Ag_2SO_4 + Ag_2 + SO_2.$$

This reaction gives very pure silver, which may be extracted by the following manner:—The mass obtained from the ignition of Ag_2SO_2 is placed in a test-tube with ammonia gently heated by means of a spirit-lamp. The silver sulphate then dissolves and leaves the metallic silver in the form of a finely divided powder, which, being collected and melted, gives an ingot of very pure metal.

II. *Silver Silicofluoride* (Ag_2SiFl_6).

By mixing aqueous solutions of silver nitrate and hydric silicofluoride this salt is obtained in the form of a greyish white precipitate—

$$Fl_2SiFl_6 + 2AgNO_3 = Ag_2SiFl_6 + 2HNO_3.$$

On precipitating the same salt from an alcoholic solution of silver nitrate it was observed that the precipitate of Ag_2SiFl_6 had a darker colour. Hydrochloric acid very easily decomposes this salt—

$$Ag_2SiFl_6 + 2HCl = 2AgCl + 2HFl + SiFl_4.$$

In the same manner acts sulphuric acid, yielding silver sulphate.

According to Berzelius a strong solution of ammonia decomposes this salt; meanwhile it was observed that a weak solution of ammonia produces an unstable gelatinous precipitate, which hangs a long time in the solution and contains the elements of ammonia.

ON PERBROMIC ACID.

By R. W. EMERSON MACIVOR, M.P.S.L., F.C.S., &c., Lecturer on Chemistry, Melbourne, Victoria.

SOME years ago Dr. H. Kaemmerer published a paper in the *Proceedings of the German Chemical Society of Berlin*, in which it is stated that perbromic acid is formed by adding bromine to hydrated perchloric acid. As it appeared, *a priori*, highly improbable that bromine could, under the circumstances specified in the paper referred to, displace chlorine from so stable a combination as perchloric acid, I, at the suggestion of Prof. Dittmar, made the experiments detailed in the present communication.

The perchloric acid employed was prepared by decomposing potassium perchlorate with sulphuric or hydrofluosilicic acid, concentrating by evaporation the solution obtained, and finally distilling it when the oily hydrate, $HOZO_4.2H_2O$, was obtained.

30 grms. of this acid were treated, in a glass retort, with 24 grms. pure bromine, which is about one-third more than is required by theory to replace the whole of the chlorine. The retort was heated on a water-bath, and in a short time almost the whole of the free bromine had passed over into the receiver. The remaining traces of dissolved bromine were removed by blowing air through the hot liquid, which then becomes almost perfectly colourless. It was cautiously neutralised with potassium hydrate, when, of course, a dense precipitate of flat white crystals was formed, which was collected, washed with small quantities of cold water, dried, and heated to expel oxygen. The residue, on careful examination, proved to be not bromide, but pure chloride of potassium. The experiment was twice repeated with the same result.

In conclusion, I am, in accordance with what has been stated, compelled to deny the correctness of Dr. Kaemmerer's assertion.

Scientific Chemical Laboratory,
Andersonian University, Glasgow.

ON THE ESTIMATION OF MANGANESE IN IRON AND STEEL.

By SAMUEL PETERS, Laboratory, Bay State Iron Works, South Boston, United States.

THE following method for the estimation of manganese in iron and steel is not new in principle, but as applied in this form to this purpose it may possibly be of interest to some of the readers of the CHEMICAL NEWS.

Dissolve 0·1 grm. pig-iron or steel in 3 or 4 c.c. nitric acid, about 1·2 sp. gr., and boil gently in a long test-tube (about 8 inches long and $\frac{3}{4}$ inch diameter) for five or ten minutes, or until solution is complete; then add an excess of PbO_2, say 0·2 or 0·3 grm., and boil again two or three minutes.* Cool the tube and its contents in water. Filter through asbestos, washing out the test-tube and the residue on the filter with distilled water until all the colour has

* It is unnecessary to filter off graphite in pig-iron before boiling with PbO_2.

been washed through. Transfer to a graduated tube (¾ inch diameter) holding 50 or 60 c.c., graduated in 0·2 c.c., and compare with a standard solution of permanganate, held in a tube for that purpose. The comparison is made in the same manner as that in the Eggertz method when estimating combined carbon in steel, &c. The solution under comparison is then diluted and well mixed with distilled water (by pouring the contents of the graduated tube into a small dish, and then transferring to the tube again), until its colour is exactly of the same intensity as the standard solution. Having attained to this point, the number of c.c. is noted, and the result is obtained by multiplying each c.c. by 0·00001. Each c.c. is equivalent to 0·01 per cent manganese when 0·1 grm. of iron is taken for analysis.

For irons containing 0·10 to 0·35 per cent manganese 0·1 grm. is the proper quantity; but if there be, say, 0·8 to 1·00 per cent, I find it best to take 0·1 grm., and divide the solution (before adding the PbO_2) in four equal parts, and use 0·25 for the estimation, taking another 0·25 for a second estimation. In case of a high percentage, as 1·00 per cent, if 0·1 grm. is taken, I find the results too low, on account of some of the manganese escaping oxidation. This agrees with the observations of others. With an unknown iron one or two trials with 0·1 grm., or half that quantity, will point out the probable amount, and so be a guide for the next trial. If the amount of iron taken does not yield more colour than corresponds to 25 to 35 c.c. of standard hue, it may safely be said that all the manganese is oxidised. I find it well to take this volume as the guide to the quantity of iron to be taken. It is well not to allow the quantity of manganese in the liquor to be tested to exceed 0·4 of a milligrm., and certainly not over half a milligrm., so far as my experience goes. By taking 0·1 grm. of a speigeleisen, containing nearly 12 per cent manganese, and diluting to 50 c.c., and taking 2 c.c., or 0·04, for the estimation of the manganese, very nearly the proper amount of manganese was obtained. This seems to show that if the division of the solution can be accurately made, and the bulk of the coloured liquid can be kept down well, the amount of manganese in speigeleisen can be estimated very fairly.

I find that combined carbon in large quantity does not interfere with the accuracy of the method, for a steel containing 2·00 per cent combined carbon, and only 0·80 per cent manganese, was found to give good results by this method.

The standard is made by diluting a permanganate of potash solution of known strength until each c.c. = 0·00001 grm. manganese.

For example, a $\frac{n}{10}$ solution will contain 3·16 grm. permanganate in 1000 c.c., or 0·0011 grm. manganese per c.c.; if this be diluted 110 times it will give the required strength. The standard is contained in a tube of the same bore as the one used for the analysis, or else the standard is put in the latter one, and a solution of permanganate put into a tube of *nearly* the same bore, and diluted until it exactly corresponds with the standard solution, when it will serve as a standard.

From a hint received from Mr. Pope, of Massachusetts Institute of Technology, I made a standard with permanganate of potash, adding nitric acid, and when it was diluted to the proper hue, added a small quantity of PbO_2, and when the powder had all settled it was used as a standard, and found to keep well for some time; but it appears, from my experience, that this solution decomposes sooner in some cases than others.

I find that *permanganic acid* of the proper hue keeps better than permanganate of potash of the same hue, and is of course easily made by adding nitric acid to the latter.

The time occupied in obtaining a result by this method is very short (about half an hour), and it appears to me to be a method that will prove of advantage in analysing steel made in Bessemer and Siemens-Martin processes.

December 28, 1875.

ON THE

BLUE COLOUR SOMETIMES PRODUCED IN THE INCINERATION OF BREAD.

By Major ROSS, late R.A.

DR. EDMUNDS showed me this interesting substance, procured from a muffle in the prosecution of his analytical duties, and asked me to what I thought the blue colour attributable. I said it *might* be due to copper oxide, for "every chemist" who has used a blowpipe knows that, with silica and soda present, copper oxide will afford "at a bright red heat," with a supply of oxygen, a blue glass. The fragments shown me had not, indeed, a vitreous appearance, but an infinitesimal number of very minute blue beads would probably communicate a blue colour to an otherwise white and non-vitreous ash. A few fragments which I took home with me gave the following results pyrologically:—

(1.) A pin's-head fragment of a brilliant blue colour was taken up at the bottom of a hot *boric acid* bead, and the fragment treated with O.P.

(*a*.) It changed to a dirty green colour, glowed about equal to lime, and was then taken up by the bead with a little effervescence.

(*b*.) Microscopically, the bead presented the following appearance:—It contained a rounded, semi-transparent, colourless, siliceous-looking mass, fast dissolving in the bead, but evidently first attempting to form a ball; this showed that, although lime or one of the alkaline earths was probably present, there was so much alkali also present that a ball could not be formed; and, indeed, after further O.P., the mass shortly dissolved transparently in the bead.

(*c*.) The boric acid's green pyrochrome was completely *yellowed*; showing that the alkali was chiefly *soda*, derived probably from the salt used in baking.

(2.) Another blue pin's-head fragment of the ash, heated with pure sodium carbonate on aluminium plate, in a *candle* H.P. (for all *coal-gas* contains sulphur compounds), afforded a *salmon*-coloured ball; which showed that a sulphide was, or sulphides were, present in the fragment.

(3.) I now crushed another blue fragment with a drop of distilled water and a few crystals of pure *boric acid* to a fine paste between agates, and boiled this paste with distilled water in a capsule in order to get rid of the soda, and part of the silica (which latter separates in solution from silicates by this treatment), from the assay.

(*a*.) The residue, obtained by decanting as much as possible of the solution, and tilting the washed remainder on a white blotting-pad, had now a slightly earthy appearance.

(4.) The residue (3 *a*.), properly dried and collected, was now attached to the bottom of a boric acid bead, and treated with O.P. as before, when it at once formed a *semi-opaque ball* (apparently) of calcium-phospho-borate,* which was yellow, hot, and green-yellow cold, from the presence of an extremely minute proportion of iron protoxide, which, in larger proportion, would have coloured the ball yellow-green. No sign of the presence of any *other* malleable metallic oxide was given by the boric acid.

(A.) It was thus evident from (1 *b*. *c*.) that *sodium*, present *as the base of a sulphide* (2), and *also*, perhaps, from the effervescence as sulphate (1 *a*.) was there, and from (4) that there was no copper (which would have formed black balls), manganese (clear brown balls), or other colouring oxide present, except that of iron, which certainly was so, but in far too trifling proportion to afford such a colour.

(B.) The change of the blue colour to green (1 *a*.) in O.P. is afforded by *Lapis lazuli* powder, which also yields, like this, a colourless icy mass when directly treated in boric

* A calcium-borate ball is [illegible] and highly refractive.

acid (1 *b.*) ("Pyrology," page 266). No sufficient evidence has been here elicited of the presence of *alumina*, though operation (3 *a.*) indicates that, because the object was to determine the cause of colour alone; but it is known ("Pyrology," pages 67, 118) that a blue colour can be obtained by certain treatment, from silica with nitrogen, as found in the Himalayan black quartz, and from pure sulphur dissolved in phosphoric acid.

(C.) Having therefore found, by the above-mentioned operations, the *absence* of any colourising oxide, except a proportion of that of iron, too minute to have such an effect; and the *presence* of the constituents of *Lapis lazuli* (with the exception of alumina, which, however, is probably present) I considered—as indeed the primary operation (1 *a. b.*) alone would have made me suspect—the blue colour to be due to the formation of *ultramarine*, and communicated my opinion to Dr. Edmunds, who informed me that he had himself, independently, arrived at a similar conclusion.

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 25.)

Dr. H. Meidinger has constructed a simplified machine to which the way has been paved by the observation that a concentrated solution of salt melts ice, producing, if the concentration be preserved, the same low temperature as does the action of solid salt upon ice.† The machine consists of the following three parts:—A cylindrical vessel (cooler) with double sides quite open at the top; secondly, a conical tin vessel (freezer) of about half the diameter of the former, reaching down nearly to its bottom and furnished above with a firmly-connected covering-plate, which rests upon the top of the cylinder and fits it tightly like a lid; lastly, an annular strainer-like vessel (the salt-holder) which is let down into the space between the cylinder and the freezer at about half the depth of the former. The cylinder is charged about half full of pounded ice, upon which is poured a concentrated solution of salt; the strainer filled with salt is then let down, and lastly, the freezer containing the materials for the ice-cream is forced in and is in complete contact with the freezing mixture over its whole surface. The ice melts in the solution of salt, which, as it becomes diluted dissolves more salt from the strainer, and thus remains nearly saturated and capable of undiminished action upon the ice. The reduction of temperature throughout the apparatus is equable, and a mechanical movement of the vessel is not required. The needful agitation of the freezing ice-cream is performed at intervals of five minutes without any disarrangement of the apparatus. The machine is constructed by Messrs. Beuttenmüller and Co., of Bretten, in an elegant form fit for the table. Recently it has been applied on a larger scale in perfumery for the separation of fatty oils from spirit.

Freezing mixtures in which a fall of temperature is produced by the solution of salts in liquids have been latterly subjected to examination in various quarters, after different small ice machines for domestic use, adapted to their application have been introduced into trade. Dr. Meidinger has drawn up a table of 16 mixtures‡ according to his own experiments. An abstract of this, comprising the most useful mixtures, is given below.

The author remarks in a note that the number 21 for ice and salt signifies the permanent temperature below 0°, which is observed till the whole mixture is melted. The correct number in relation to the other freezing mixtures would be 81°, *i.e.*, the sum of the latent heat of ice 79°, and the dissolving temperature of salt 2·5°. This temperature would be actually observed if a concentrated solution of salt had no freezing-point, when the entire mass of ice and salt would melt at once.

Mixtures of salts yield a far greater decrease of temperature than the salts singly, as they dissolve together in far less water. One part sal-ammoniac dissolves in 3 parts of water and produces a fall of temperature of 19°. Saltpetre dissolves in 6 parts of water and lowers the temperature 11°. Compare with these the fourth and fifth mixture in the foregoing table. The fifth is also especially to be noticed in comparison with the fourth.

The three last columns of the table show the consumption of materials and the cost (retail and wholesale) for 120 heat-units, which suffices, in case of the salt and ice mixture, for the conversion of 1 kilo. of water into ice. The other mixtures only convert about ½ kilo. with the same consumption.

(To be continued.)

Mixture.	Fall of Temp.	Sp. Heat of Solution.	Sp. Gr. of Solution.	Loss of Heat-units for 1 kilo. of Mixture.	Loss of Heat-units for 1 litre of Mixture.	Quantities to be used for 120° C. Heat-units. Salts. Kilos.	Water. Kilos.	Cost.§
1 Salt. 3 Ice.	27°	0·83	1·18	125	100	0·5	1·5	0·34 to 0·12
3 Sulphate of soda crystals. 1 Conc. hydrochloric acid.	37°	0·74	1·31	55	74	2·7	1·8	1·0 to 0·6
2 Nitrate of ammonia. 1 Sal-ammoniac. 3 Water.	30°	0·70	1·20	42	51	3·0	3·0	7·6 to 6·8
3 Sal-ammoniac. 2 Saltpetre. 10 Water	26°	0·76	1·15	49	46	2·1	4·2	2·6 to 2·2
3 Sal-ammoniac. 2 Saltpetre. 4 Sulphate of soda cryst. 9 Water	32°	0·72	1·22	59	61	2·5	2·5	1·5 to 1·6

* "Berichte über die Entwicklung der Chemischen Industrie Während des Letzten Jahrzehends."

† Meidinger, *Bad. Gew.*, 1872, Beil. No. 6. *Dingl. Pol. J.*, ccix., 149.

‡ Meidinger, *Bad. Gew.*, 1872, No. 6.

§ These stand in decimals of a shilling, assuming the shilling to be approximately equal to the German "mark."

A STUDY OF HYDROCARBONS.
No. I.—The Constitution of Alizarin.

By S. E. PHILLIPS.

(Concluded from p. 27.)

There is yet another element of possible variation in these compounds, which may or may not subsist isomerically.

The very numerous mono- and dibasic acids of modern chemistry will very probably resolve themselves into two classes—(1st). The ordinary mono-hydrates, which we have seen in the case of hydrochinon and others, behave generically like alcohol. (2nd). The few terbasic acids which take rank with succinic, tartaric, and others of so-called *diatomic* characters.

Of the former kind we have pyromucic acid—

$$C_{10}H_3O_4,O.HO.$$

Of the latter, itaconic acid, $C_{10}H_3O_4,O.3HO$.

Myristyl, $(C_{28}H_{27})H$.
$(C_{28}H_{27}O_2)O.HO$, Myristic acid.

$C_{28}H_{28}H$, Dibenzyl.
$(C_{28}H_{27}O_2)O.HO$, Ethylen diphenol.
Sulpho-acids, $HO,S_2O_5.C_{28}H_{27}O.S_2O_5$.
$HO,S_2O_5.C_{28}H_{13}O_4.O.S_2O_5$.
$C_{28}H_{13}O_4.HO$, Carminic acid.
$C_{28}H_{11},H$ (?)
$C_{28}H_{11}O.HO$, Methyl-benzophenon.
$C_{28}H_{11}O_2.HO$, Benzyl-benzoic acid.
$C_{28}H_{11}O_3.O.HO$. Benzydril-benzoic acid.
" " Diphenyl-glycollic acid.
$C_{28}H_{11}O_8.HO$, Quinic acid.
$C_{28}H_{10}$, Anthracen.
$C_{28}H_9O.HO$, Anthracen aldehyd.
Sulpho- and carbo acids, $HO,CO_2.C_{28}H_{9}O.CO_2$.
$HO,SO_2.C_{28}H_{9}O.SO_2$.
$HO,S_2O_5.C_{28}H_{9}O.S_2O_5$.
$C_{28}H_9O_4.HO$, Benzoyl-benzoic acid.
$HO.S_2O_5.C_{28}H_9O_4.O.S_2O_5$.
$C_{28}H_9O_6.HO$, Chrysophanic acid.

$C_{28}H_9O_8.HO$, Frangulinic acid.
$C_{28}H_{7}H$ (?)
$C_{28}H_7O.HO$, Anthracen aldehyd.
$C_{28}H_7O_2.HO$, Anthraquinon.
$C_{28}H_7O_4.HO$, Oxy-anthraquinon.
$C_{28}H_7O_6.HO$, Alizarin.
$C_{28}H_7O_8.HO$, Purpurin.
$C_{28}H_7O_{10}.HO$, Ruliopin.
$HO,SO_2.C_{28}H_7O_2.O.SO_2$.
$HO,S_2O_5.C_{28}H_7O_4.O.S_2O_5$.
$HO,S_2O_5.C_{28}H_7O_4.O.S_2O_5$. &c.

$C_{28}H_4O_4$, Diphenic acid.
A strong bibasic acid, $C_{28}H_7O_4,O_3HO$ (?)
$C_{28}H_{10}O_{24}$, Jervic acid.
A tetra-basic acid, $C_{28}H_5O_{18},O.5HO$ (?)

Or we may compare them isomerically:—
Of the former, piperonylic acid is
$C_{16}H_7O_4.O.HO = C_{15}H_7O_3$
Of the latter, phthalic acid is $C_{16}H_4O_4.O.3HO = C_{16}H_6O_8$
It is instructive to trace these in their ammoniacal and sulpho-acid derivatives. The former are indistinguishable except in isomeric property; the latter are distinct both in type and individual characters. The pyromucic or itaconic amides are $(C_{10}H_3O_4)H_2N$. The sulpho-acids are mono-basic in one case and tribasic in the other.

There are two very characteristic features of present hypothesis in chemical philosophy. One is the predominant character of the benzol *nucleus*; the other is the special character of quinon production in the sense we have referred to. And I now submit that both look very small in the light of those wider analogies I have so faintly glanced at. With limited means, and from an amateur point of view, I have done very little in this wide field; but it may be well to indicate the direction and character of research.

In a rough, tabular study of these bodies we have as one of the points of view a generic outline of acid genesis. In this rough book one page is devoted to each group or series, and the headings are based on the ratios of C and H, thus —C_4H_5, C_4H_3, C_5H_4, C_6H_7, C_8H_7, $C_{10}H_7$, $C_{14}H_7$, $C_{16}H_7$, $C_{18}H_7$, $C_{20}H_7$, beyond which, as the ratio is more unusual, several are comprised under one page, up to the extreme ratio of $C_{80}H_7$!

A condensed oxy-benzoic acid being the only representative as yet of that ratio it is—

Acid + 7Acid − $14HO = C_{112}H_{35}O_{32},O.HO$.

At the onset five pages are devoted to the predominant ratio of C_4H_5, and these are in three columns each.

After this the pages are a more general survey, irrespective of varied oxy-ratios; for instance, page 11, under the heading $C_{10}H_7$, ranges from phonic or collic acid, $C_{12}H_8O_2.O.HO$, up to cholesterin, with $C_{52}H_{42}O.HO$, with many intermediates. Page 13 similarly comprehends the homologues of $C_{14}H_7$, with chelidonic acid, $C_{14}H_4O_8.O.HO$, meconic acid, $C_{14}H_4O_{10},O.3HO$, through naphthyl hydride and hydrate up to ethyl naphthyl, $C_{24}H_{11},H$.

Another and more general tabular estimate of hydrocarbons proceeds from a different point of view, and has for initial starting points the higher ratios of H, being variously paged from C_2H_3, C_4H_3, C_6H_7, &c., up to $C_{60}H_{61}$, and under these are comprised a condensed picture of the leading types progressing downwards to the lesser ratios of H. I insert the myristyl page as an illustration. (See Table above).

The pervading idea of these tabular studies is the good old motto—"A place for everything, and everything in its place;" but it is extremely difficult to construct any comprehensive outline of materials so infinitely varied.

Enough has, however, been said to show that benzol in its chemical relations is only one of an extended series of homologues, and in the general play of dedoublement or substitution the same features apply more or less to all.

Acetic acid, $C_4H_3O_2.O.HO$.

Tri-methacetic acid, $C_4Me_3O_2.O.HO = C_{13}H_{13}O_4$.

The latter was discovered by M. Boutlerow, a solid substance that distils without decomposition and with an odour recalling that of acetic or valeric acid. Now valeric acid is $C_{10}H_{10}O_4$, and the two are therefore isomeric. Yet farther, just as this is a trimethyl acetic acid, so we may have a triphenyl acetic acid, or the H atoms of benzol may be thus replaced in similar ways.

Meth-alcohol ..	$C_2H_3O.HO$	Formic acid ..	$C_2H_2O_2.O.HO$	Glyoxalic acid ..	$C_4H_2O_4.O.HO$
Alcohol	$C_4H_5O.HO$	Acetic acid ..	$C_4H_3O_2.O.HO$	Pyruvic acid ..	$C_6H_2O_4.O.HO$
Propyl alcohol ..	$C_6H_7O.HO$	Propionic acid..	$C_6H_5O_2.O.HO$		&c.

Column 1 extends progressively up to melissic alcohol, $C_{60}H_{61}O.HO$. Column 2 comprises the fatty acids. Column 3 extends through rocellic acid, japinolic acid, and others. The principle herein is that the same formula and character of generic reaction by alcohols give fatty acids: so these similarly give Column 3.

As page 1 may be called the alcohol group, so page 2 may be the glycol group.

How or why alizaric acid has been considered di-basic involves a very wide and important question, which I am most anxious should be freely and fairly canvassed, and while deferring that for another paper I may conclude this with the assurance, strong almost to certainty, that the phenols, quinons, and alizarin are all simply monohydrates of the kind and character represented in these tabular connections.

Glycol.. ..	$C_4H_6O_2.HO$	Glycollic acid..	$C_4H_4O_3.O.HO$	(?) ..	$C_4H_4O_6.O.HO$
Propyl glycol..	$C_6H_8O_2.O.HO$	Lactic acid ..	$C_6H_6O_3.O.HO$	(?) ..	$C_6H_6O_5.O.HO$

Page 3 = a glycerine group. Page 4 an erythrite series. Page 6 is the aldehyd group.

Alcohol ..	$C_6H_7O.HO$	(?) ..	$C_6H_6O_2.O.HO$		
Allylic aldehyd..	$C_6H_5O.HO$	Acrylic acid ..	$C_6H_4O_2.O.HO$	Tetroleic	$C_6H_4O_4.O.HO$
Butylic aldehyd	$C_8H_7O.HO$	Crotonic acid ..	$C_8H_6O_2.O.HO$	(?)	$C_8H_6O_4.O.HO$

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, January 20th, 1876.

Professor ODLING, F.R.S., Vice-President, in the Chair.

THE names of the visitors having been announced, and the minutes of the previous meeting read and confirmed, the following names were read for the first time, Messrs. R. G. W. Typke, F. S. Earp, H. Mitford Faber, B.A., Gerrard Ansdell, J. M. H. Munro, W. J. Williams, N. B. Cooke, D. Walker, G. Harrow, J. Parry, W. Ashwell Shenstone, and C. Williams. Messrs. William Henry Watson, Ernest Holbrooke Gaskell, T. Sebastian Davis, Samuel E. Levy, W. Lamond Howie, Martin F. Roberts, George William Wood, James Hargreaves, Henry Wilson Hake, and Henry Glover, after their names had been read for the third time, were balotted for and duly elected.

Dr. ARMSTRONG exhibited a specimen of pure crystallised glycerin from Messrs. Dunn and Co., of Stratford, a portion of a bulk of 40 pounds. The crystallisation had been induced by exposure to the cold of the early part of January combined with the agitation of a journey by rail. Its sp. gr. at its melting-point 60° F., was found by Dr. van Hamel Roos to be 1·261.

The CHAIRMAN said the Fellows were no doubt much interested in seeing such a rare object as glycerin in the crystalline state. A specimen had once before been exhibited at the Society's meetings some years ago by Dr. Gladstone. In both instances the crystals were formed under similar circumstances, exposure to shaking at a low temperature.

Mr. J. WILLIAMS said he had found hydrocyanic acid to be a very delicate test for the purity of glycerin. If the glycerin were perfectly pure, the mixture might be kept for a twelvemonth without change, whilst a slight trace of impurity in the glycerin caused the mixture to assume a yellow tinge in a short time.

A discussion then took place amongst some of the Fellows as to the possibility of fusing, and then re-crystallising the crystalline glycerin, without exposing it to long-continued and violent agitation.

Mr. E. NEISON then read a "*Note on Sebate of Cobalt*," in which after referring to the discrepancy between his description of cobalt sebate and that subsequently published by Dr. Otto Witt in the Berlin *Berichte* gave the details of the preparation of this salt from pure cobalt carbonate and pure sebasic acid. Although he had made considerable quantities under various conditions, he always obtained either the vivid purple-blue coloured anhydrous salt as described in his former paper, or a rose-coloured hydrated salt which was readily converted into the blue anhydrous salt by drying. This salt is soluble in about 185 parts of water. The author did not obtain in any case the stable rose-coloured compound insoluble in water described by Dr. Witt.

The CHAIRMAN having thanked the author for his examination into the properties of this cobalt salt, Dr. WRIGHT read Part IV. of "*Narcotine, Cotarnine, and Hydrocotarnine; On Oxynarcotine, a New Opium Educt, and its Relationship to Narcotine and Narceine*," by himself and Mr. G. H. Beckett. The new base oxynarcotine was extracted from the residues of the preparation of narceine by dissolving it with certain precautions in dilute sulphuric acid, re-precipitating with soda, and exhausting the product with successive small quantities of water, which dissolved the narceine and left the sandy crystals of the new base. This was purified by treatment with hot spirit, conversion into the hydrochloride, and re-precipitation by a slight excess of caustic potash. Oxynarcotine crystalises in micaceous sandy crystals whose composition is represented by the formula $C_{22}H_{23}NO_8$. It forms a hydrochloride, $C_{22}H_{23}NO_8HCl,2H_2O$.

It having been ascertained that ferric chloride did not oxidise opianic acid to hemipinic acid, the new base was submitted to its action, and the resulting products were found to be hemipinic acid and cotarnine, in accordance with the equation—

$$C_{22}H_{23}NO_8 + O - C_{10}H_{10}O_6 + C_{12}H_{13}NO_7.$$

Oxynarcotine, therefore, differs from narcotine in containing the carboxyl group instead of the aldehyd group, and may be represented by the formula—

$$C_{11}H_{11}(CH_3)NO_3 - CO - C_6H_2(OCH_3)_2(COOH).$$

Narceine when submitted to the oxidising action of potassium dichromate and dilute sulphuric acid yielded hemipinic acid together with methylamine; very similar results were obtained with other oxidising agents, from which it would appear probable that the formula for narceine is $C_{13}H_{20}NO_4 - CO - C_6H_2(OCH_3)_2(COOH)$. The action of a dilute solution of potash on narceine seems to give rise to trimethylamine and a kind of weak acid of the formula $C_{23}H_{23}NO_8$. When fused with the hydrate, narceine yields protocatechuic acid.

In reply to a question of the Chairman as to the oxidising action of ferric chloride on narcotine, Dr. WRIGHT explained that it seemed probable that narcotine first split up into opianic acid and hydrocotarnine thus, $C_{22}H_{23}NO_7 + H_2O = C_{10}H_{10}O_5 + C_{12}H_{15}NO_3$, and that by the action of the ferric chloride the latter was oxidised to cotarnine, $C_{12}H_{13}NO_3$.

Mr. DAVID HOWARD said it would be very interesting to ascertain the physiological effect of the new base on animals, as by comparing it with that of narcotine it might throw some light on the question as to where the physiological action lies.

Dr. WRIGHT remarked from the results already obtained it seemed that if two bases were alike, except that one contained more hydrogen than the other, the former was the most active; thus hydrocotarnine was more active than cotarnine.

Dr. ARMSTRONG said the authors had not stated as to whether they had been able to isolate any definite substance from the product obtained on heating oxynarcotine with water. He thought it would give considerable insight into the constitution of narcotine.

Dr. WRIGHT replied that the action of water at 140° to 150° C. gave rise to a brown tarry mass, from which they had been unable to isolate anything except traces of methylamine.

The SECRETARY then read a note "*On a Method for Estimating Bismuth Volumetrically*," by Mr. M. M. P. MUIR. The author estimates the metal by precipitating a nearly neutral solution of the nitrate by potassium chromate or dichromate in a manner similar to that proposed by Pearson, but he ascertains the critical point by testing the clear solution from time to time with argentic nitrate until red argentic chromate is produced; the chromium solution being previously titrated with a solution of bismuth of known strength. The presence of chlorine, sulphuric acid, calcium, copper, or arsenic interferes seriously with the results obtained by this method.

The CHAIRMAN, in thanking the author, said he thought the directions were somewhat vague as to the strength or degree of concentration of the liquids in which the bismuth was to be determined, a matter of some importance. The quantitative results obtained, however, seemed to be very satisfactory.

Mr. DAVID HOWARD remarked that the great practical difficulty in estimating bismuth was that in most cases it had first to be separated from other metals, as lead, copper, arsenic, and antimony. After it had been separated it was a comparatively simple matter to determine the amount.

The meeting was then adjourned until Thursday

February 3, when papers will be read "On the Formation of the Hydrocarbons of the C_nH_{2n} and C_nH_{2n-2} series, and their Combination with the Haloid Acids and other Compounds," by Dr. H. E. Armstrong; "Note on the Formation of Anthrapurpurin," by Mr. W. H. Perkin, F.R.S.; On High Melting-Points, with Special Reference to Metallic Salts," by Mr. T. Carnelly; "On Metachromism or Colour Changes," by Mr. W. Ackroyd. The Chairman also announced that on February 17th there would be a lecture by Dr. Frankland, F.R.S., "On some Points in Connection with the Analysis of Water."

NOTICES OF BOOKS.

A Manual of Electro-Metallurgy. By JAMES NAPIER, F.R.S.E., F.C.S., &c. London: C. Griffin and Co.

WE have here before us the fifth edition of a work which has, since its first appearance, been deservedly popular among all who feel an interest in this department of electrical science. Although the wonder with which "galvano-plastic" was greeted at its first appearance has died away, the importance of the art has not lessened. The author, whilst bringing forward the most recent practical improvements, does not overlook theoretical considerations. We quote from his preface the following passage:—"I have, I think, pretty clearly proved that dynamic electricity, at least, is one simple and undecomposable force, by the discovery that when it passes through a fluid in sufficient strength to decompose it the elements of the fluid are not mutually transferred from one electrode to another, which the compound theory would necessitate, and which is asserted by electricians to take place. I have also shown that when the electric force passing through any fluid is too weak to decompose it, there is produced a current of the fluid in one direction only, not in opposite directions, as the two and equally powerful force theory would necessitate. Although upwards of thirty years have elapsed since these facts were made known, subsequent books and lectures on the physical and chemical sciences have continued to uphold the dogma of two electricities in electrolytic action, causing a mutual transfer of elements from pole to pole."

The Textile Colourist: a Journal of Bleaching, Printing, Dyeing, and Finishing Textile Fabrics, and the Manufacture and Application of Colouring Matters. Edited by C. O'NEILL. No. 1, January, 1876. Manchester: Palmer and Howe. London: Simpkin and Marshall.

THE editor of this new journal tells us in his preface that:—"Although some of the existing serials do give a little space to articles connected with textile colouring, this is the first attempt to establish a journal in this country entirely devoted to the subject." This is doubtless technically true. Still it strikes us that Mr. O'Neill somewhat underrates the amount of space devoted to tinctorial questions in our technological literature. However, in so far as this undertaking may aid in the development of the arts of dyeing and calico printing in England, we wish it success. In a paper on "Lime-juice and Argols, Citric and Tartaric Acids," we find the following passage, with which we most cordially agree:—"A large amount of information is acquired in the laboratories of our great manufacturing concerns; most of this might be published without any injury to the individual manufacturer. Especially is this true of analytical methods, and the publication and discussion of these would do much to remove the disgrace to which science is often subjected from the wide discrepancies of commercial analysis."

The Retrospect of Medicine. Edited by W. BRAITHWAITE M.D., and JAMES BRAITHWAITE, M.D. Vol. lxxii., July—December, 1875. London: Simpkin, Marshall, and Co.

THIS issue, though fully maintaining its value as regards the medical profession, contains very little matter of chemical interest. We extract the following passage on the comparative action of alcohol and beef-extract:—"The experience gained during the Ashantee campaign showed that alcohol, though apparently beneficial when given with food after the day's march was done, was injurious while on the march, the reviving effect passing off after, at the utmost, two and a half miles' march had been accomplished, and being succeeded by languor and exhaustion as great or greater than before. When again resorted to its reviving power was less marked, and its narcotising influence was often traceable in the dulness, unwillingness to march, and loss of cheerfulness of the men. Meat extract, on the contrary, in quantities of not less than half an ounce at a time, was not only powerfully reviving, but sustaining, and so was coffee, though to a considerably less extent."

First Report of the Commissioner of the Imperial Mint, Osaka, Japan, for the Half-year ending 30th of 6th Month of 8th Year of Meiji. Hiogo: Printed at the "Hiogo News" Office.

THIS document bears evidence of the progress of industrial science in the Japanese Empire. A number of the English officials of the Mint have left, their engagements being expired, and have been succeeded by Japanese. Mr. Dillon, however, the assayer and superintendent of the melting department, and Mr. W. Gowland, chemist and metallurgist, remain, and have been appointed "technical advisers" to the Commissioner of the Mint. From the special report of these two gentlemen we gather the following facts:—

The Japanese copper is still found remarkably free from arsenic, and in only one case was antimony found present.

"When a Japanese clay does not already contain quartz or chalcedony in coarse fragments the addition of the latter substance (preferably previously calcined) in sufficient quantity increases enormously the refractory power of the bricks made from it. The large quantities of chalcedony available in Japan will prove of great importance when metallurgical processes are conducted on an extensive scale, and fire-resisting materials are sought after, especially as the natural sands hitherto examined are without exception exceedingly fusible, and quite unfit alone for use where high temperatures are required."

Mention is made of a portion of copper (100 tons) which contained 99·17 per cent of copper, and only very small quantities of iron, lead, and sulphur, but was supersaturated with cupric oxide. Hence the loss on refining amounted to 14 per cent.

CORRESPONDENCE.

ON THE NECESSITY FOR ORGANISATION AMONGST CHEMISTS.

To the Editor of the Chemical News.

SIR,—Owing to unavoidable absence, I did not receive, in time for correction, the proof of the article in the CHEMICAL NEWS (vol. xxxiii., p. 27) "On the Necessity for Organisation amongst Chemists." Permit me, therefore, to take this opportunity of correcting a slight *erratum* on page 28, column 1, line 15:—*For* "evidence of experts, as such," *read* "evidence as experts, of such persons."

It was not intended to suggest (as, perhaps, might be

supposed from the text as it stands) that certificates of analysis generally, and the evidence of experts as a class, should be inadmissible in courts of law, but only that the certificates and evidence of such practitioners as those referred to (viz., non-licentiated ones) should not be admitted.—I am, &c.,

CHARLES R. ALDER WRIGHT.

St. Mary's Hospital, Paddington, W.
January 22, 1876.

THE MINERALOGICAL SOCIETY.

To the Editor of the Chemical News.

SIR,—I was glad to see in the CHEMICAL NEWS (vol. xxxiii., page 19) an announcement that it had been arranged to hold the first general meeting of the Mineralogical Society of Great Britain and Ireland, for the election of officers, &c., at the rooms of the Scientific Club, 7, Savile Row, on Tuesday, February 3, and that the chair will be taken at 12 at noon, by Mr. H. C. Sorby, F.R.S.

This announcement is immensely gratifying to me, inasmuch as it was thought by some of my friends that my rough mode of showing, in your columns and elsewhere, the necessity for some such society, would fail in the enlistment of sympathisers.

Happily, it has not so proved, for more than a century of workers are enrolled already; and when I see amongst them such names as Ansted, Church, Crookes, Davies, Geikie, Greg, Haughton, Heddle, Jones, Nicol, and Sorby, I fancy that I see the beginning of the end of "Doubtful Minerals" and "Dual Mineral Nomenclature."—I am, &c.,

T. A. R.

Liverpool, January 24, 1876.

SODA TESTS.

To the Editor of the Chemical News.

SIR,—Mr. John Pattinson's note in the CHEMICAL NEWS (vol. xxxiii., p. 17) reminded us—but too late to correct ours of the 12th inst.—that 31 = soda = 31·40 by the commercial test, not 32. We therefore ask your permission to correct our figures, and to read 98⅝ lbs. (98·72) instead of "97 lbs. (96·57);" 53·20 for "54·20 per cent of alkali;" and 52·60 for "51·60 per cent," which last correction involves the cancelling of our concluding sentence.

For the satisfaction of your readers, who may not at a glance discern why 31 NaO. = 31·40, the commercial test, which rests on carbonate of soda, a reliable salt, we subjoin the proportion—

$$NaO.CO_2 . NaO. :: NaO.CO_2 . NaO.$$
$$54 : 32 :: 53 : 31{\cdot}40$$

which will doubtless make it plain. May we also pray that "writers'" be read "writer's," and "invoice" "inverse."—We are, &c.,

E. F. TESCHEMACHER and J. DENHAM SMITH.

1, Highbury Park North, N.,
January 22, 1876.

SODA TESTS.

To the Editor of the Chemical News.

SIR,—Whilst I fully concur in what your correspondent, "Z," has stated to be a disgrace to the profession, I must emphatically contradict Messrs. Teschemacher and Smith that it is a trade question whether the standard, that is the equivalent, for soda is to be taken as 32 or 31. It is a well known fact that manufacturers and merchants do not like to relinquish or alter their customs, unless the reason be so obvious that it needs no discussion. But in this case the necessity for an alteration, though irrefutable among chemists, does not appear to be as readily acknowledged by the trade, and the question arises—Shall chemists allow laws to be imposed upon them by those who, to a great extent, have no judgment as to the right or wrong of their certificates? or shall these simply be given on the basis of scientific truth? The answer, indeed, cannot be doubtful to all who appreciate the latter, and it is to be regretted that a firm of the reputation of Messrs. Teschemacher and Smith should have given vent to these sentiments. If such publications become known, is it to be wondered at that the respect for chemistry as a profession does not stand higher in this country? The formation of a guild among chemists, as proposed by Dr. Wright, to whom I give my hearty approval, would certainly help to have such controversies speedily settled; and it is to be hoped that the existence of a society of those professional chemists to whom scientific truth is the first incitement in the exercise of their profession, may protect chemists generally from the necessity of forming a league for the defence against trade customs.—I am, &c.,

G. R.

SODA TESTS.

To the Editor of the Chemical News.

SIR,—I can confirm Messrs. Teschemacher and Smith in saying that "many erroneous reports and beliefs are in circulation on this subject," and at the same time free myself from the appearance of having merely carelessly assumed that they did not filter. In conversation on the subject of the recent letters in the CHEMICAL NEWS, a large consumer of ash, of very many years' experience, whom it did not occur to me to doubt, said that whatever the Liverpool people might do Teschemacher used 31. I therefore—perhaps hastily—assumed it might be so, and then it followed, as the only possible way of making my results on that basis agree with theirs, that they must have taken in the residues, and my examples (the only duplicate samples I had left) showed on that assumption, and on that basis, a moderately near agreement.

I am surprised at the results they obtain from my figures, if I understand their meaning correctly. It is, average of my samples 52·50 at 31 = 54·20 at 32 equivalent, whilst the average of their certificates is only 53·30, being a gain of 0·9 to us as consumers. The 54·20 appears to have been obtained thus—31 : 32 :: 52·50 : 54·20. Surely Messrs. Teschemacher have here made the error pointed out by Mr. Pattinson. The real difference is only 0·77 on 58·49, as will be seen further on. This correction applied to my figures makes them stand thus:—

	Na_2O (Na_2 = 23) in Solution.	Add to make Na_2 = 24.	Total.	Teschemacher's Certificate.
I.	53·82	0·71	54·53	54·40
II.	53·57	0·71	54·28	54·20
III.	50·18	0·66	50·84	51·20
Average ..	52·52	0·69	53·21	53·27

Using the same calculation to the records of my analyses for last year, and comparing them with the certificates, I have much pleasure in saying that I perfectly accept Messrs. Teschemacher's statement that they do filter, and will add at the same time that the estimations appear to have been very carefully made.

As regards decimals, Mr. Pattinson says (vol. xxxiii., p. 17), "I have always understood that in the alkali trade no fractions, not even 0·9, are charged or paid for," and treats it as a kind of set-off against the loss to the buyer by the use of the 32 equivalent.

Messrs. Teschemacher's plan of reporting up to 0·6, which is not charged on the invoice, and then going up to the next whole number, seems to the unitiated to do the same thing, but only gives the buyer "the turn of the scale," and the seller all the appearance of generosity, but no compensation to the buyer for the use of the 32 equivalent. Mr. Pattinson's suggestion of reporting all the

decimals as they are found, and letting buyers and sellers settle it themselves, seems much better.

As to the 32 equivalent, Messrs. Teschemacher say it would be desirable, for the sake of preventing both confusion and fraud, if the 31 could be adopted. Trade customs are, without doubt, very difficult to alter. But allow me to suggest a plan, which seems to me easy to carry out, that is, for the analysts to make out their certificates substantially as follows:—

Soda (Na=24)	59·26
Soda (Na=23)	58·49

(I have filled in the theoretical percentages of pure carbonate to show the difference in the use of the two equivalents.) Contracts could then be made on whichever basis buyers and sellers might determine, and perhaps before many years the 32 equivalent would disappear.

Thanking you much for the space you have devoted to this subject, and trusting good results will follow,—I am, &c.,

SAMUEL HALL.

East London Soap Works, Bow, E.,
January 24, 1876.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences. No. 25, December 20, 1875.

Crystalline Boride of Manganese, and on the Part Played by Manganese in the Metallurgy of Iron.—MM. Troost and P. Hautefeuille.—The effects of manganese in the metallurgy of iron are due to the formation of compounds which are produced with a liberation of heat greater than that arising from the corresponding compounds of iron, and to the easy scorification of these compounds.

Oxyfluorides of Niobium and Tantalum.—M. A. Joly.—Not suitable for abstraction.

Determination of Alkaline Metals in the Silicates, and in Matters not Attacked by Acids, by means of Hydrate of Baryta.—M. A. Terreil.—Reserved for insertion in full.

New Method of Producing Trichloracetic Acid.—M. A. Clermont.—When the reaction of permanganate of potash upon the hydrate of chloral is at an end, the brown oxide of manganese is separated by filtration over asbestos. Concentrated phosphoric acid is added in excess, and the mixture is distilled. When the thermometer reaches 195°, all that passes over is pure trichloracetic acid, which, if slowly cooled, crystallises at 44·8°.

No. 1, January 3, 1876.

Internal Constitution of Magnets.—M. J. Jamin,—The author concludes that a bundle of steel plates will always be stronger than a single bar of steel of the same dimensions, and the proportion will increase indefinitely with the number of the plates. This view justifies the use of slender laminæ in the construction of magnets.

New Thermic Researches on the Formation of Organic Compounds: Acetylen.—M. Berthelot.—"The elementary formation of a first fundamental compound, produced—with absorption of heat, and under the influence of an energy foreign to their direct reaction—a compound which subsequently evolves heat whilst forming in a direct manner other compounds, of which it is, properly speaking, the radical; this formation, I say, does not merely characterise the union of carbon and hydrogen: the same phenomena are observed also in the synthesis of many other binary compounds formed in accordance with the law of multiple proportions. Such is, eminently, that of the oxides of nitrogen, all formed with the evolution of heat, if we set out from the binoxide of nitrogen—a fundamental compound whose electro-synthesis, on the contrary, absorbs heat."

Manner in which Calorific Vibrations may Expand Bodies, and on the Coefficient of Expansion.—M. de St.-Venant.—This paper consists, to a great extent, of mathematical formulæ, and requires the accompanying diagram.

Sixteenth Memoir on the Electro-Conductivity of Imperfect Conductors.—M. Th. du Moncel.—Not suitable for abstraction.

New Crystalline Hydrate of Hydrochloric Acid.—MM. I. Pierre and E. Puchot.—If concentrated commercial hydrochloric acid is submitted to a very low temperature, no portion is separated out in a crystalline form, even if kept for a very long time at from $-25°$ to $-30°$, but if a continuous current of nearly dry hydrochloric acid gas is passed through it the result is different. When the temperature of the liquid has fallen to $-21°$ or $-22°$, and is kept there for a few minutes after supersaturation, it rises spontaneously to $-18°$, although the freezing mixture remained at $-25°$. From this moment an abundant crystallisation ensues, and the temperature remains without sensible variable variation at $-18°$. The crystals on exposure to the air are decomposed, giving off dense white fumes. In water they dissolve rapidly. They contain four equivalents of water to one of dry hydrochloric acid. The authors recommend snow and hydrochloric acid as a frigorific mixture, with which they have obtained the temperature of $-35°$.

New Fundamental Law of Electro-Dynamics.—M. R. Clausius.—A purely mathematical paper.

Phenomena of Induction.—M. Mouton.—Not suitable for abstraction.

Part Played by Acids in Dyeing with Alizarin and its Congeners.—M. A. Rosenstiehl.—The author has shown in a former paper that the best results are obtained in dyeing with alizarin and purpurin by adding to the baths equal equivalents of these substances and of lime in the state of soluble bicarbonate. In continuing his researches he has discovered further facts relating to the chemical function of these tinctorial bodies. If a dye-bath is made up of water containing bicarbonate of lime, as the temperature rises there is produced a chemical action between this salt and the colouring matter, the result of which is the formation of an insoluble lime-lake, which takes no part in the process of dyeing. Comparative trials have shown that in the best conditions the loss is one-fifth of the colouring matter. In the former paper it was shown that carbonic acid rapidly decomposes the alizarin lime-lake; that it acts more slowly upon that of purpurin; but that it, by its presence, very much retards the formation of the latter lake. It results from this observation that the loss may be avoided by passing into the bath a continuous current of carbonic acid. Experiment confirmed this: in presence of carbonic acid the formation of lime lakes is prevented, the bath can be totally exhausted, and the colours obtained are notably more intense. After having proved the good effect of carbonic acid on the small scale, he repeated his experiments on quantities from 100 to 200 times larger, so as to approach the conditions of industrial operations. He dyed pieces of 25 metres in 50 litres of water. The result of these experiments was very different from that obtained on the small scale. No useful effect resulted from the employment of carbonic acid, except the quantity of carbonate of lime was decidedly too large. Hence the author concludes that in operating on the large scale the same losses are not experienced as on the small, although in the two cases the same colouring matters are used in the

same proportions and in identical conditions of temperature. The cause of this remarkable discrepancy lies in the mass of carbonic acid naturally dissolved in the water, and proving an obstacle to the formation of calcareous lakes. It is soon expelled from the small volume of water used in laboratory experiments, whilst a longer time is required for its escape from a large volume of water. Hence the dyeing may be completed, and the bath be exhausted before all the gas has escaped into the air. This explains a fact well known to practical men, the cause of which was unknown: it is impossible to execute several successive dyeings in the same bath, even if it is reset with chalk and tinctorial matter. The carbonic acid has partly escaped during the first operation, and what remains is not sufficient for a new operation. Hence this gas, as naturally dissolved in the water, plays an important part. The author then made a series of experiments with several salts of lime, and found that acetate of lime and acetic acid may advantageously replace the carbonate and carbonic acid. During the operation the mordanted tissue laid hold at once of the lime and of the colouring matter. The acetic acid is set at liberty, and evaporates in the water or accumulates in the bath without at all injuring the saturation of the mordants, which is thus easily effected in an acid medium. He has tried the action of this salt on the various colouring matters of madder, on the extracts, and on artificial alizarin, and found that it precipitates none of them, if we do not overstep the proportion of two equivalents of acetate to one of colouring matter, and take care to acidify the bath from the beginning. The colours come out of this bath perfectly saturated; the bath is perfectly exhausted, and is, after dyeing, more limpid than if carbonic acid had been used. The same beneficial results were observed on the large scale. The advantages of this method are evident: it is no longer necessary to exhaust the bath at once; and we may dye in presence of an excess of colouring matter, working at a lower temperature and in less time.

Phosphates of Sesquioxide of Iron and of Alumina.—M. Millot.—The author describes the following salts:—$2PO_5,Fe_2O_3,8HO$; $3PO_5,2Fe_2O_3,8HO$; $PO_5,Fe_2O_3,4HO$; $2PO_5,3Fe_2O_3,8HO$; $PO_5,2Fe_2O_3,4HO$; $2PO_5,Al_2O_3,8HO$; $3PO_5,2Al_2O_3,16HO$; $PO_5,Al_2O_3,2HO$; $2PO_5,3Al_2O_3,8HO$. All these phosphates of iron and alumina if dried at 100° are hygrometric, and re-take moisture from the air. These salts are all insoluble in acetic acid, soluble in ammoniacal citrate of ammonia, oxalate of ammonia, alkaline carbonates, and ammonia. The phosphates of alumina are much more soluble in these reagents than the corresponding salts of iron.

A Secondary Hexylic Alcohol.—M. W. Oechsner de Coninck.—The compound obtained has the composition $C_6H_{14}O$. It is limpid, very mobile, refracts light strongly, possesses an agreeable ethereal odour, and a burning taste.

Assimilability of Fossil Phosphates, and on the Danger of the Exclusive Use of Nitrogenised Manures.—M. A. Roussille.—The use of sulphate of ammonia on soils poor in phosphoric acid in some cases actually diminishes the crop.

Preparation of Gaseous Hydrobromic Acid.—M. A. Bertrand.—The author uses 100 parts bromide of calcium, 50 of water, and 100 of sulphuric acid. The hydrobromic acid is not decomposed, as in case of the alkaline bromides. Or he treats 100 parts of bromide of potassium with 100 parts of syrupy phosphoric acid, mixed with 300 parts of water.

Les Mondes, Revue Hebdomadaire des Sciences,
No. 17, December 23, 1875.

The purple of *Murex trunculus*, one of the molluscs yielding the purple of the Ancients, contains two tinctorial principles, of which one is identical with indigotin. Chemical and spectroscopic analysis shows in *Elysia viridis*, and in other mollusca, chlorophyll identical with the green colour of plants.

Experiments with the Electric Light.—A few weeks ago a new so-called pyro-electric apparatus was exhibited on the roof of the works of Messrs. Siemens and Halske, of Berlin. The light produced was strong enough to enable ordinary writing to be read at the distance of a mile. A mirror was placed before the apparatus so as to reflect the luminous rays upon the heavens. A luminous train, like the tail of a comet, was thus thrown upon the clouds, in which signals made before the mirror could be distinctly traced. The War Department intends to purchase several of these apparatus for military and naval purposes.

M. Orsat has devised an apparatus for executing gas analyses with rapidity, and with all the exactitude requisite for industrial purposes.

Analysis of the Touchstone.—

Silica	84·40
Alumina	5·25
Oxide of iron	1·15
Lime	0·43
Magnesia	0·13
Potash	0·69
Soda	1·70
Lithia	spectroscopic traces
Phosphoric	traces
Sulphur	0·05
Water	0·60
Organic matter. Nitrogen	0·70
Organic matter. Hydrogen	0·19
Organic matter. Carbon	0·09
Loss	4·37
	0·25
	100·00

No. 18, Dec. 30, 1875, and No. 1, Jan. 6, 1876.

These issues contain no chemical matter.

M. Reimann's Farber Zeitung, No 1, 1876.

A union of German woollen manufacturers is in the course of formation to oppose the importation of foreign, and especially of English, woollens by inducing the Government to raise the scale of duties. Judging from the fate of the iron import duties these gentlemen need not expect much success in their laudable undertaking.

The well known extractor of dye-woods—Dubosc, of Havre—is about to introduce into the market a new extract containing gallic (?tannic) acid prepared from the Brazilian Quebracho wood (*Aspidosperma*). The new extract is to form a substitute for catechu, sumach, &c.

Justus Liebig's Annalen der Chemie,
Band 179, Heft 3.

Nature and Origin of Meteorites.—Dr. Mohr.

Investigations on Isomerism in the Benzoic Series: on the Dichlorobenzoic Acids.—F. Beilstein.—In order to ascertain the influence of pre-existing groups or elements upon a recently-introduced atom of chlorine the author examined the behaviour of para- and orthochlorobenzoic acid in this respect. Parachlorobenzoic acid was converted into ordinary dichlorobenzoic acid, whilst a new acid was obtained from the ortho-acid.

Communications from the Laboratory of Kasan.—These comprise a paper on the serial succession of the apposition, and separation of the elements of hydriodic acid in organic compounds, by Alexander Saytzeff; on amylen bromide and amyl-glycol from diethyl carbinol, by G. Wagner and A. Saytzeff; transformation of diethyl carbinol into methyl-propyl-carbinol, by G. Wagner and A. Saytzeff; on butylen bromide a d butyl-glycol from

normal butylic alcohol, by N. Grabowsky and A. Saytzeff; attempt at the production of a secondary alcohol with the ethyl and allyl radicals, by J. Kanonnikoff and A. Saytzeff; on diallyl carbinol, by Michael Saytzeff; on the isomerism of the amylenes obtained from the amylic alcohol of fermentation, by F. Flavitzky.

Relative Constitution of Eugenic Oil.—Dr. Max Wassermann.—A lengthy paper, not adapted for abstraction.

MISCELLANEOUS.

Chemistry Extraordinary.—Our attention has been called to a lengthy review of Mr. Proctor's "Our Place among Infinities" which appears in a recent issue of the *Hour*. In it we find, passing over minor prodigies, the following truly marvellous passage:—"Now, we should like very much to know whether any chemist has ever been able to produce a gas which glows of itself or becomes red-hot. Long before such a stage is reached all known gases *explode*, and then nothing remains but a small particle of dust and a vacuum around it. Science, in fact, teaches us that to obtain a gas we must first possess a substance, and therefore to form an atmosphere we must first obtain a solid earth." Will the writer oblige men of science by exploding nitrogen, or hydrogen, or oxygen by the application of heat far below redness, or indeed at any temperature whatever? Or will he kindly explode any pure gas so that nothing may remain but "a small particle of dust and a vacuum around it?" We should much like to know what kind of man can have gravely and deliberately penned such intolerable nonsense. Did any daily paper commit itself in a similar manner upon questions of history, law, politics, or theology it would be well-nigh laughed out of existence. But physical science is, it appears, so unimportant a matter that there is no necessity to employ competent men for its discussion. That Mr. Proctor's work should be reviewed in an article which teems with errors and gives evidence of ignorance that would be discreditable in a school boy is a disgrace to the age and the nation.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

Improvements in the recovery of alkali from the liquid in which esparto, wood, straw, or other material has been boiled. D. A. Fyfe and W. H. Bowers, both of Manchester, Lancaster. December 1, 1874.—No. 4112. The inventors inject streams of heated air or hot gases from furnaces into the liquid to be evaporated. They also burn out the carbon in the residuum in chambers, and employ the hot gases issuing therefrom as aforesaid.

Improvements in the mode of and apparatus or machinery for the treatment of fibre and manufacture of pulp, and in the recovery of chemicals used. C. H. Roeckner, Newcastle-on-Tyne, Northumberland. December 1, 1874.—No. 4117. This consists—1. Of a propeller for giving the pulp an upward direction by itself or in combination with an uptake. 2. Placing fibre boilers in diagonal position and rotating same. 3. Removing injurious material by causing same to boil over, or by skiming. 4. Obtaining suction in strainers by oscillating fan; and diagonal blades or a worm are used for propulling knots or other impurities. 5. The chemicals are recovered by using tanks with compartments below one another, liquor flowing from one to the other; when sufficiently evaporated it is drawn off to calciner.

Improvements in the means of and apparatus for clarifying cane-juice, the same being also applicable to the production of triphate of lime or other combination of sulphurous gas, or carbonic acid gas, or other gas with an alkali. B. Hunt, Serle Street, Lincoln's Inn, Middlesex. (A communication from J. Girdwood, Kingston, Jamaica.) December 3, 1874.—No. 4153. To carry this invention into effect the air in the juice- or liquor-box is first exhausted by a Gifford's injector, which causes the sulphurous gas produced in a furnace of ordinary construction, and washed, as has been hitherto accomplished, by a falling shower of water, and then stored in a receiver, to pass therefrom into the box; the cane-juice is then allowed to fall into a trough from a gutter from the mill. The trough causes the juice to spread into a thin stream, so that it falls through the cover of the box into two trays (perforated with diamond holes), equally across its whole width, falling through the holes of the trays in a shower which, owing to the shape of the holes, takes a "fish-tail" shape, widening as the fall, thereby subdividing the particles of liquor more fully than round holes could, and absorbing a larger quantity of sulphurous gas. The cane-juice fallen to the bottom of the box is, by the usual acting of the injector, drawn up by its lower pipe, its upper pipe at the same time drawing from the box a current of the sulphurous gas. At the junction of these two pipes the sulphurous gas is brought again into direct contact with the cane-juice, and passes through the injector along with it, under a considerable pressure, into the pipe leading into the clarifiers; the cane-juice is thus elevated into the clarifiers, and made to absorb more of the sulphurous gas. The entire apparatus can also be used for the production of bisulphite of lime or other combination of sulphurous gas, or carbonic acid gas, or other gas, with an alkali, by using water in which lime or any other alkali has been dissolved in place of the cane-juice.

Improvements in the mode of cleaning cotton-waste, and in utilising the fluids employed therein. A. Ford, Woburn Square, Middlesex. December 3, 1874.—No. 4156. This invention relates to improvements in the mode of cleaning cotton-waste, and in utilising the fluids employed therein, of the character described in the Specification of Letters Patent granted to the said Alfred Ford, dated January 22, 1874, No. 269, and the novelty of the present improvements consists in employing oleaginous substances for the purpose of liquefying the oil contained in dirty cotton-waste, and thereby enabling the same to be effectually pressed out.

Improved means or method of clarifying impure water or sewage, and preparing the precipitate or sludge for re-use. R. Goodall, Armley, near Leeds, York. December 3, 1874.—No. 4158. I take common ashes, or gas-lime, or waste lime, and add thereto sulphuric acid or brown oil of vitriol; I then add water in sufficient quantity to make the mass flow along pipes. When the impure waters contain soapy or unctuous matter, I use slacked lime first, or the following mortar, say. 6 parts of slacked lime and 1 part animal carbon ground together with water, and agitate. I then add a portion of acid mixture as above, and agitate the whole together. To prepare the sludge for re-use I lift it on to strainers, and allow it to remain for a time to thicken, and then mix it about the proportion of one-third sludge to two-thirds newly slacked lime, and grind the mixture, which may then be used to clarify.

Improvements in the manufacture of carbonates of soda. L. Mond, Northwich, Chester. December 4, 1874.—No. 4175. This invention refers to the production of carbonates of soda, by the process known as direct, by ammonia; and consists in a purification of the brine, and in securing the presence of sulphur during the production of the said carbonate. Also in obtaining a more dense monocarbonate.

Improvements in the manufacture of artificial manures. W. H. R. Wise, Duke Street, Adelphi, Westminster. December 4, 1874.—No. 4176. This invention relates to the manufacture of artificial manures from various animal, mineral, and vegetable matters, and consists in the mode of treating such matters, and the proportions and conditions in which they are mixed. The various matters are treated as follows:—Manure is made from blood by mixing it with sulphuric acid and soot or ashes, or both, and then drying the mixture. Manure is made from the other animal matters by treating them in a similar manner after preparing them as follows:—The softer kinds of animal and fish offal are reduced to a pulpy state by mechanical means. The fat and gelatine are separated from bones, and the harder kinds of animal matter by boiling, and the residuum is then boiled under steam pressure. Instead of making the matters above enumerated into separate manures they may be combined to form one manure. In this case the prepared bones are mixed with blood to which sulphuric acid has been added; a quantity of offal is then added, and the mixture is stirred, and sulphuric acid and soot or ashes are added, and the whole is dried.

Improvements in the treatment of hydrocarbons in combination with other substances, and in the manufacture of a hard material therefrom. G. H. Smith, New York, and H. C. Paterson, George Square, Glasgow. December 5.—No. 4194. This invention relates to the manufacture from the substances hereinafter mentioned of a new material that is suitable for building and other like purposes. A material suitable for blocks and bricks is made from two mixtures. The first contains coal-tar, or other analogous hydrocarbon, mixed with small broken stones or shingle, a portion of which should be pulverised or mixed with sand, so that the interstices between the stones of larger size may be properly filled up. The second mixture is composed of clay and pitch; sand or chalk may be substituted for the clay, and analogous hydrocarbons for the pitch. The first mixture is mixed in a mixing apparatus at a heat which is gradually increased until the product is adhesive to the touch. The second mixture is formed by grinding the powder thus obtained, and is added to the first mixture while its particles are adhesive to the touch. The mixture of the two compounds is confined in a close vessel, and heated so as to diffuse the vapours uniformly throughout the ingredients. In manufacturing a building block, the material having been tested, is removed while hot to moulds, and pressed and shaped as required. A valuable material may be made by an analogous process to that described above, sawdust or vegetable fibres being substituted for shingle, &c. In some cases the sawdust or fibre is mixed directly with the second compound. In this invention the quantity of hydrocarbon is very small compared with the other ingredients, and it is made to diffuse itself over the particles of the clay.

NOTES AND QUERIES.

* * Our Notes and Queries column was opened for the purpose of giving and obtaining information likely to be of use to our readers generally. We cannot undertake to let this column be the means of transmitting merely private information, or such trade notices as should legitimately come in the advertising columns.

Cleaning Engravings.—Will you be good enough to tell me, through the medium of the CHEMICAL NEWS, how I can best remove stains from engravings? I have tried a solution of chloride of lime, and succeeded in removing the stains, but could not get rid of the lime. Though I washed the print for six hours there remained, upon drying, a crystalline deposit on the face of the print. If I use a second bath of hyposulphite of soda as an anti-chlor will it not be as difficult to remove it from the fibre of the paper as it is to remove the lime? and would not the crystallisation of the hypo in the body of the paper be just as destructive as that of the lime would be?—PERPLEXED.

MEETINGS FOR THE WEEK.

SATURDAY, Jan 29th.—Physical, 3. "Photography of Fluorescen Substances," by Dr. J. H. Gladstone, F.I .S

MONDAY, Jan. 31st.—Medical, 8.
—— London Institution, 5.

TUESDAY, Feb. 1st.—Civil Engineers, 8.
—— Zoological, 8.30.
—— Royal Institution, 3. "On the Classification of the Vertebrated Animals," by Prof. Garrod.

WEDNESDAY, 2nd.—Society of Arts, 8.
—— Geological, 8. "Evidence of a Carnivorous Reptile (Cynodrakon major, Ow.) about the size of a Lion, with Remarks thereon," by Prof. Owen, C.B., F.R.S., F.G.S. "On the Occurrence of the Genus Astrocrinites (Austin) in the Scotch Carboniferous Limestone Series, with the Description of a New Species (A.? Bennici), and Remarks on the Genus," by R. Etheridge, jun., F.G.S. "On the Genus Merycochærus (Fam. Oreodontidæ), with Descriptions of Two New Species," by G. T. Bettany, B.A., B.Sc.
—— Microscopical, 8. (Anniversary).
—— Pharmaceutical, 8.

THURSDAY, 3rd.—Royal, 8.30.
—— Royal Institution, 3. "On the Chemistry of the Non-Metallic Elements," by Prof. Gladstone.
—— Royal Society Club, 8.30.
—— Chemical, 8. "On the Formation of the Hydrocarbons of the C_nH_{2n} and C_nH_{2n-2} Series and their Combination with the Haloid Acids and other Compounds," by H. E. Armstrong. "Note on the Formation of Anthrapurpurin," by W. H. Perkin. "On High Melting-Points, with special reference to Metallic Salts," by T. Carnelley. "On Metachromism, or Colour Changes," by W. Ackroyd.

FRIDAY, 4th.—Royal Institution, 9. "Applications of Electricity to Protect Life on Railways," by Mr. Preece.
—— Mineralogical (7, Savile Row), 12. "On the Scottish Rhombohedral Carbonates," by Prof. M. Forster Heddle, M.D., F.G.S.E.
—— Geologist's Association. (Anniversary.)

SATURDAY, 5th.—Royal Institution, 3. "On Excavations in Asia Minor," by R. P. Pullan.

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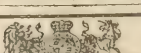

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THE DETERMINATION OF MANGANESE IN SPEIGELEISEN.

By WILLIAM GALBRAITH.

As is well known to those who frequently have occasion to determine the amount of manganese in speigeleisen, the usual methods are tedious and require great care on the part of the analyst. If sodium acetate is used to separate the iron, the oxide of manganese retains a considerable quantity of soda, which is extremely difficult to get rid of; and, on the other hand, if ammonium acetate is used, the precipitation of the manganese is very slow or it requires a large excess of bromine.

Although the above methods have been in use for a long time no attempt seems to have been made to get a more expeditious one, or at all events none have been successful until Mr. Parry showed that a definite oxide of manganese could be got which enabled him to determine the manganese very accurately and expeditiously. His method is simply to dissolve a weighed quantity of the speigeleisen in nitric acid (sp. gr. 1·20) in a small pear-shaped flask, evaporate to dryness, and heat pretty strongly over a Bunsen burner or spirit-lamp for about ten minutes. He then treats the contents of the flask exactly as a manganese ore, heating with sodium oxalate and hydrochloric acid, and measuring the resulting carbonic acid.

The apparatus he uses (which was devised for the purpose) is, he states, a modification of Schiebler's, but as a matter of fact has many advantages over that apparatus, excellent as it is. One very decided advantage is that it admits of heating the solution, and altogether it would be very valuable in a laboratory, where the accurate estimation of carbonates or the measurement of gases are frequently required.

As everyone, however, has not got the apparatus, I thought it would be advisable to show that the manganese could be determined some other way.

If it is admitted that Mn_2O_3 can be easily formed, a number of methods immediately suggest themselves as being likely to give the amount of manganese, prominent among which is the well-known method of treating with hydrochloric acid, and passing the resulting chlorine through a solution of iodide of potassium, the liberated iodine being titrated with sodium hyposulphite. ("Fresenius," fifth edition, p. 135). Accordingly I tried that method, but although I took every care, and returned to it again and again I completely failed to obtain accurate or even constant results. This seems strange (I may say that Mr. Parry had previously tried and failed also), and at first I attributed my failure to the fact that I was not getting Mn_2O_3, but was afterwards convinced that it is much easier to get that oxide than at first sight it appears. I can scarcely avoid coming to the conclusion that there is something wrong with this method of determining free chlorine.

The next method I tried proved in every way successful. I proceed exactly as Mr. Parry does (and find no difficulty in getting Mn_2O_3). 1 grm. of the speigeleisen is dissolved in nitric acid (sp. gr. 1·20) in a small round-bottomed flask, and evaporated to dryness. When dry the flame, which may be either a spirit-lamp or a Bunsen burner, is turned so that the bottom of the flask is cherry-red, for ten minutes. It is then allowed to cool very gradually.

At this point instead of forming carbonic acid, I simply put into the flask a weighed quantity of ammonio-ferrous sulphate or ferrous sulphate of a known strength, and then heat with rather dilute hydrochloric acid. The contents of the flask very soon dissolves, but it is well to keep shaking the solution while it is being heated to prevent loss of chlorine. It only remains now to determine the iron left unoxidised in order to arrive at the quantity of manganese, which can be done of course with potassium bichromate solution. If it is feared that the ferrous solution may get oxidised by exposure to the air, a small piece of marble put into the flask, which can also be fitted with a cork and tube, will readily prevent that.

In four successive experiments I obtained the following results:—

No.	Fe Oxidised.	Equal to Manganese p. c.	By Parry's Method.
1	0·2018	19·82	20·16
2	0·2103	20·65	20·85
3	0·2396	23·53	23·75
4	0·2435	23·88	—

No. 2 gave by the acetate of ammonium method 20·55 per cent, which was done with great care. No. 4 is a repetition of No. 3.

It is evident of course that there is nothing original or new in the above method, but it contrasts very favourably with the usual methods of separating the iron with sodium or ammonium acetate, and precipitating the manganese from the filtrate with bromine. It is not at all troublesome, does not take long, and has the advantage that the only chemicals and apparatus required are those which are necessary for the assay of iron ores.

Ebbw Vale, Mon.

ON SOME NEWLY OBSERVED PROPERTIES POSSESSED BY CERTAIN SALTS OF FULMINIC ACID.*

By EDMUND W. DAVY, M.A., M.D.

Professor of Forensic Medicine, Royal College of Surgeons, Ireland

THE salts of fulminic acid, or the fulminates, have not received the attention which the interest arising from their extraordinary properties would lead us to expect. This is, no doubt, due in a great measure to their being such highly explosive and consequently dangerous compounds, which have already occasioned several serious and even fatal accidents to individuals whilst making them objects of research: they are, therefore, considering the amount of personal danger attendant on a study of their properties, not very inviting subjects of inquiry, and necessitate the exercise of much caution on the part of those engaged in their investigation.

The compound which is known to chemists under the name of fulminic acid, and which is expressed by the empirical formula $H_2C_2N_2O_2$, though it has never yet been isolated or obtained in the free state, is capable, as is well known, of forming a number of simple and compound salts, which are endowed with more or less explosive properties. Of those salts, by far the most important is the fulminate of mercury, which constitutes, as is well known, the active constituent of the percussion caps, and of the detonating matters which are used to fire the charges in our guns and pieces of ordnance; and for those purposes it is now manufactured in large quantities, and forms a very important instrument of modern warfare, since by its employment the use of flint and steel, matches, and other rude means of firing small and large guns have been quite abandoned, at least among all civilised nations.

Whilst making some experiments on the fulminate of mercury, I observed that when that salt and the ferrocyanide of potassium, both in aqueous solution, are gently heated together, the mixture at first acquires a faint reddish yellow tint, which quickly passes into a port-wine or deep purple colour, without the separation apparently, at

* A Paper read before the Royal Irish Academy.

least at first, of any gas or solid matter. The development of this colouration, under the circumstances stated, being considered very singular, and hitherto unnoticed (as far as I have been able to ascertain), led me to study the matter more closely, to determine the nature of this coloured compound, and of the changes taking place in its formation.

On prosecuting this inquiry, I further ascertained that when the purple compound was fully developed, if the heat was continued for some time, or more quickly if the temperature was raised to and maintained at the boiling-point, the purple colour gradually disappeared, the liquid acquiring a light yellow tint, whilst more and more of a reddish brown solid matter (which was ascertained to be the peroxide of iron) was produced; these changes being accompanied by the evolution of more or less of ammonia, and by the mixture, which was at first quite neutral, acquiring a strong alkaline reaction. The solution being filtered, and concentrated by evaporation, was found to yield small prismatic crystals of a colourless or very light yellow salt, which appears to be a double cyanide of potassium and mercury.

Considering that the principal feature of interest in the reaction of the fulminate on the ferrocyanide was the formation of the purple compound, my attention was chiefly directed to its investigation. But I soon ascertained that this compound was a substance of a very unstable character, and that it presented great difficulties in the way of its separation from the matters with which it was associated, as procured in the reaction referred to; and not being able to obtain it in a pure or suitable state to submit it to actual analysis, I was for a considerable time unable to obtain any clue as to its real nature, further than it was some organic compound of iron, in which cyanogen, or at least its elements, were constituents.

At last it occurred to me that the colouration observed might be in some measure connected with the formation of the fulminate of iron; and on making some of that salt, and comparing its reactions with those of the compound referred to, many points of agreement between them were at once perceptible. I may observe that the fulminate of iron is readily obtained by the action of metallic iron on the fulminate of mercury suspended in water. Thus if about equal bulks of the fulminate and of fine iron filings are placed in a small stoppered bottle, which is then filled with distilled water, and being closed is occasionally agitated, the liquid in a short time acquires a yellowish tint, which gradually deepens in colour, whilst the filings become tarnished, and more or less of mercury, in the form of minute globules, make their appearance. After a few hours the decomposition of the fulminate of mercury will be more or less complete, and on filtering the mixture a dull yellow liquid is obtained, which holds the fulminate of iron in solution. This fulminate, as so obtained, was described by my late father amongst several other compounds of fulminic acid, which he was, I believe, the first to discover, during his elaborate researches on that acid. This salt was observed by him to produce, when treated with diluted acids, a fine red or purple colour, which disappeared after some time, evolving hydrocyanic acid amongst other products. He also found that a somewhat similar colour, rapidly changing to a bluish black, with a precipitate of that colour, was developed on heating this fulminate.

But this development of colour only occurs in the case of the freshly prepared fulminate of iron, for the salt, being one of very great instability, commences almost immediately after its formation to undergo spontaneous changes, which are attended by the separation of a dark brown substance, even when the solution is kept excluded from the air in a well stoppered bottle: and after such changes have taken place it ceases to develop, either by the action of acids or by heat, the colouration just stated. My father also observed that alkalies produced in freshly prepared fulminate of iron a dull green precipitate, quickly changing to a brown colour, which is obviously due to the separation of iron as an oxide from the fulminate of iron And I have myself observed that the light yellow liquid which remains after the action of the alkalies and the separation of the oxide at once develops a fine port-wine colour when it is treated with diluted acids, and that the colouration so produced is much more stable than that developed by directly treating the fulminate of iron similarly; and that this red- or purple-coloured compound resembles in all its characters that produced in the new reaction of the ferrocyanide on the fulminate of mercury already referred to.

As to the singular development of colour when the fulminate of iron is treated with dilute acids, I am not aware that any explanation has as yet been given; and the one that I would now suggest accounts for its production, not only in the case of the fulminate of iron, but also in the new reactions which I have myself recently observed, and explains some of the properties of this curious purple-coloured compound. To make the explanation I would offer intelligible, I should first observe that fulminic acid is generally regarded as a bibasic acid, which is capable of forming two classes of salts, viz., the neutral and the acid salts. In the first, the two atoms of hydrogen in the hydrated acid ($H_2C_2N_2O_2$) are replaced either by two atoms of a monad metal, as in the case of the fulminate of silver ($Ag_2C_2N_2O_2$), or by one atom of a dyad metal, as in the fulminate of mercury ($HgC_2N_2O_2$). In the second class we have either one atom of hydrogen still retained, whilst the other is replaced by a monad metal, as in the case of the acid fulminate of silver ($AgHC_2N_2O_2$), or two atoms of hydrogen are retained (the molecule of fulminic acid being doubled) where a dyad metal occurs, as in the acid fulminate of mercury ($HgH_2(C_2N_2O_2)_2$). Now as iron in most of its combinations plays the part of a dyad, we should express its neutral fulminate thus, $FeC_2N_2O_2$: and when this salt is treated with a diluted acid there is formed, as I conceive, an acid fulminate of iron (a hitherto undescribed salt) by the following reaction, where, for example, sulphuric acid has been employed,—

$$2FeC_2N_2O_2 + H_2SO_4 = FeH_2(C_2N_2O_2)_2 + FeSO_4,$$

and that it is this acid fulminate which possesses the red or purple colour, whilst it is at the same time much more stable or less prone to decompose than the neutral salt. If this acid fulminate is treated with an alkali its purple colour disappears, owing, as I conceive, to the formation of a neutral double fulminate of iron and the metal of the alkali, which is a colourless salt in dilute solution; thus in the case of potash being added to the acid fulminate of iron, there would be a double neutral fulminate of iron and potassium formed, according to the following reaction:—

$$FeH_2(C_2N_2O_2)_2 + 2KHO = FeK_2(C_2N_2O_2)_2 + 2H_2O;$$

and this colourless solution being treated with a diluted acid again develops the purple colour by the re-formation of the acid fulminate, as the following equation indicates:—

$$FeK_2(C_2N_2O_2)_2 + H_2SO_4 = FeH_2(C_2N_2O_2)_2 + K_2SO_4.$$

Or, again, if to some freshly prepared fulminate of iron a dilute solution of caustic potash be carefully added, the mixture will continue (as I have observed) neutral so long as the alkali produces a further precipitate of the oxide of iron; and when it ceases to do so, if the mixture be then filtered, a light yellow solution will be obtained, which holds dissolved, as I conceive, a double neutral fulminate of iron and potassium resulting from the displacement of one-half the iron in the neutral salt, as is shown in the following equation:—

$$2FeC_2N_2O_2 + 2KHO = FeK_2(C_2N_2O)_2 + FeO + H_2O;$$

and this double fulminate develops, as before observed, the purple colouration when treated with a diluted acid, and again becomes colourless, or very nearly so, on adding an excess of alkali, especially after the application of heat, and the colour can be again restored by acidifying the mixture, and these changes may be produced many times in succession.

For the production of the acid fulminate of iron the

double neutral salt is much preferable to that of the simple neutral fulminate of that metal, as in the latter case there will be produced, as before shown, a proto-salt of iron, which reacts on the acid fulminate, occasioning its more or less rapid decomposition.

I may further observe that on heating the double fulminate just described there will be developed the red or purple colouration, unless there is present too great an excess of alkali. This remark, however, does not apply to the case of ammonia, the excess of which being expelled by heat does not interfere with its production.

This development of the acid fulminate by heat is not so easily accounted for as where it has been due to the action of acids; it may, however, depend on the circumstance that the simple neutral and double fulminate of iron, are both easily resolvable by heat under certain conditions into the acid fulminate.

I shall now point out how the explanation I have given of the production of the purple colouration in the case of the fulminate of iron may likewise serve to account for the similar development of colour, which I have myself observed, in the reaction of the ferrocyanide of potassium on fulminate of mercury. My experiments would seem to show, that when those compounds react on each other, there is at first formed, amongst other products, the double fulminate of iron and potassium, which, like that salt prepared directly, as already described, from the fulminate of iron, passes into the purple acid fulminate of that metal, on being heated or treated with diluted acids; the following formulæ and equation explaining the production of the double salt, accompanied, as it is in this case, by the cyanide of mercury and potassium:—

$$2HgC_2N_2O_2 + K_4FeCy_6 = FeK_2(C_2N_2O_2)_2 + 2HgCy_2 + 2KCy.$$

Amongst other facts which might be mentioned in support of the foregoing statement is the following one that I have observed, that when the ferrocyanide of potassium and the fulminate of mercury, along with water, react on each other at the ordinary temperature, the mixture after a short time acquires a yellowish tint, which gradually passes into that of a reddish shade; and if a portion of the mixture in this early stage of reaction be treated with a drop or two of any dilute acid, or is heated, the deep purple colouration which results when the double fulminate is similarly acted on will at once be developed. I shall now briefly notice some of the more characteristic properties of the acid fulminate of iron as obtained by the action of the ferrocyanide of potassium on the fulminate of mercury, most of my experiments having been made on that salt as so procured. When that compound is dissolved in water it appears to possess, at the ordinary temperature, considerable stability, for it has been exposed to the air and even light in an open vessel for several weeks without its appearing to undergo any change of colour; but when the solution is allowed, even spontaneously, to evaporate to dryness, the dark purple residue very soon passes to a brown colour, from the decomposition of this salt, and the separation of its iron in the form of peroxide; and this proneness to decompose in the dry condition may account for the residue not exploding on the application of a strong heat, the salt having quietly decomposed before reaching the temperature necessary to explode it or other fulminates; and I may further observe, that even in aqueous solution it soon decomposes if the temperature is raised to the boiling-point, its decomposition being attended with the separation of peroxide of iron and ammonia.

It does not appear to be soluble in ether, chloroform, bisulphide of carbon, or in benzol, though it is readily dissolved by alcohol.

It is quickly decomposed by strong acids, with the evolution of hydrocyanic acid and the development of Prussian blue, and even in their diluted condition the same occurs, but more slowly.

The caustic alkalies, at the ordinary temperature, slowly decolourise its solution; with the assistance, however, of heat that effect is quickly produced.

It appears to possess but little, if any, disposition to assume a crystalline form, for as yet all my attempts to obtain it separately in such a condition have been unsuccessful.

Several experiments were made as to the effects of different metallic salts on this compound, but no very characteristic results were observable, except in the case of the nitrate of silver, which produced a dull bluish precipitate, leaving the liquid colourless if sufficient of the silver salt be added. This precipitate, however, is one of great instability, for it very soon loses its blue colour (even when lying at the bottom of the stratum of liquid from which it has been precipitated), and becomes of a white or yellowish white appearance.

If, however, while it still retains its blue colour, it is treated with diluted hydrochloric acid, or with an alkaline chloride, the solution regains its original purple colour, whilst the chloride of silver precipitates; but if the addition of the acid or chloride be delayed till after the precipitate has become white, then both fail to reproduce the purple colouration, owing to the previous decomposition of the silver compound.

This red or purple combination appearing to be but little affected by many of the metallic salts seems to strengthen the view I have taken as to its nature, for had it been a peculiar cyanogen compound, such as we have in the case of the ferro-, ferri-, and nitro-ferricyanogen, as well as in other compound salt radicals of that substance, we should have expected that it would have produced very characteristic effects with different metallic salts.

I may further observe that the same compound is formed when the ferricyanide of potassium (or as it is better known under the name of red prussiate of potash), instead of the ferrocyanide of potassium (the yellow prussiate), in aqueous solution is heated along with the fulminate of mercury, and that it, as well as the ferrocyanide, even without the application of heat, give rise to, but more slowly, the formation of the red or purple combination, the ferricyanide acting, however, in this respect more readily than the ferrocyanide.

Lastly, I may add that I found that a similar purple compound was produced when the fulminate of silver was substituted for the mercurial salt in the reactions referred to, and that it is probable that some at least of the other fulminates would give rise to like effects.

I regret that the results which I have brought before the Academy are not, in some respects, of a more definite character; but all who have experimented on the fulminates have experienced the great difficulties of such enquiries, arising from their instability and complexity of constitution; but I hope before long to be able to investigate more fully the subjects of this communication, as well as other matters bearing on them. I trust, however, that the results of the observations which I have already made may not be considered as devoid of interest, as any facts which may extend our knowledge of fulminic acid (a compound regarding the true nature of which chemists are not yet agreed) must possess more or less interest in a scientific point of view; and it is well known that many facts and observations, which at first have been regarded as mere matters of interest to men of science, have afterwards proved of much practical utility.

Verification of Instruments.—The Kew Committee of the Royal Society give notice that in order to afford to the public greater facilities for the verification of instruments at Kew than have hitherto existed, they are prepared to undertake the transport of instruments, &c., from London to Kew and back, free of charge. With this object they have made arrangements for Mr. R. Strachan, of the Meteorological Office, 116, Victoria Street, to receive at that office any instruments intended for verification. As soon as the instruments have been verified and are returned to London, notice will be sent from Kew to the parties concerned.

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 37.)

THE ice and salt mixture, which is added for comparison, will be seen to be much more efficient and much cheaper than all mixtures, if it is intended to use the materials only once. The second mixture, Glauber's salt and hydrochloric acid, cannot be re-used, as likewise the last mixture in the table. These two are still relatively cheap. The mixture, which, by evaporating the solution of the saline residue, can easily be restored to its original state (nitrate of ammonia and sal-ammoniac), requires such a heavy outlay that it would be out of the question if used only once. It was used in an apparatus by S. Charles, which first became known at the Paris Exhibition of 1867. This consisted of a small wooden cask with a perforated lid. The inner vessel containing the articles to be frozen was made of tin, and was fitted with a screw-thread so that when caused to revolve it effectively mixed the salts and the water. Another modification, by Toselli and Co., of Paris, is known as the glacière italienne roulante.† It consists of a tall tin capsule in which a conical tin tube is suspended. A good cover connects both vessels, and the internal tube in which are put the materials for the ice-cream is also stoppered separately. The freezing mixture occupies the annular space around the tube. When charged the whole apparatus is wrapped up in cloth and rolled up and down upon a table. In efficiency both forms of apparatus are nearly equal, but the first mentioned is more convenient. Neither has come extensively into use, at least not in places where ice is to be procured. It is necessary to work upon large quantities in obtaining trifling results. 4 kilos. of mixture yield scarcely 1 kilo. of ice-cream of less firmness than that prepared with ice and salt, or a little more than ½ kilo. in summer. Where cold spring-water is not to be had, or where no cold cellar exists the result is altogether doubtful without repeating the operation twice over, the first process being the preparation of cold water, which is too tedious.

The evaporation of the saline solution in order to recover the salt is a task such as does not otherwise occur in the kitchen, and requires some care in its performance. The total of the process is not adapted for domestic arrangements even though the expense of restoring the salts be insignificant.

We have now to examine in how far the solution of salts is available for the production of ice on a commercial scale. This question can be arithmetically answered by means of the figures given in the table. To prepare 1 kilo. ice from water at the mean temperature of 12° C., not much less than 120 heat-units will be consumed if we take losses into consideration. This amount is, indeed, yielded by the mixture of nitrate of ammonia and sal-ammoniac, but little more than the half of this falls below 0° C., since the substances used in the most favourable case will have this initial temperature. The cold still contained in the spent mixture, when no longer applicable for freezing, may, indeed, be transferred to the water used in a fresh mixture, and thus the total cold of solution below 0° may be conceivably utilised, losses being neglected. We require, therefore, 3 kilos. of water for 1 kilo. of ice, and in the regeneration of the materials these 3 kilos. of water must be evaporated by artificial heat. The effect of 1 kilo. of coal burnt under the evaporating pan amounts to little more than 6 kilos. of steam. Consequently 1 kilo. of coal yields little more than 2 kilos. of ice, overlooking, too, the mechanical power required. This result is very unfavourable since other ice-machines produce a better effect—the ammonia apparatus four to five times greater. Hence no arrangement for the manufacture of ice on the large scale has been constructed on this principle, although it would have a great advantage in simplicity of structure, requiring merely open vessels. Nor can we expect that the circumstances will ever appear more favourable, except salts are discovered which during their solution produce a fall of temperature several times greater than that of the known mixtures. But this is improbable, since all known salts have been examined in this respect. If common salt were so costly a body that its recovery were desirable, not more salt than would serve for 4 kilos. of ice could be recovered by the consumption of 1 kilo. of coal in evaporating the spent mixture.

We may finally mention that in 1869 Rüdorff‡ examined the fall of temperature to be obtained by the solution of single salts. His table of results contains 20 salts, among which we call attention to two not yet mentioned, as they produce the lowest temperature of any single salt; the sulphocyanides of ammonium and of potassium. 105 parts of the former dissolved in 100 parts of water produce a fall of 31·2°; 130 parts of the latter in 100 parts water lower the temperature 34·5°.

(To be continued.)

BLOWPIPE IMPLEMENTS.

By P. CASAMAJOR.

THE title of this communication obliges me to explain that I have no intention of adding to the formidable list of appliances which dealers include under the name of *complete set* of instruments for blowpipe analysis.

I propose to describe a new form of pocket blowpipe and an easily constructed apparatus for holding charcoal and other supports, and to call attention to supports made of common things that are found everywhere whose use I have had to adopt from time to time as emergencies arose.

Pocket Blowpipe.—In his incomparable book, "On the Use of the Blowpipe in Chemical Analysis and Mineralogical Determinations," Berzelius says that "As it is very desirable, especially for those who study mineralogy, that the blowpipe should take up little room and be convenient to carry without depriving it of its essential qualities, several chemists have endeavoured to attain the last limit of simplicity in the construction of this instrument. The most remarkable blowpipes in this respect are those of Tennant and of Wollaston."

Not being fully satisfied with these, nor with other forms which have come under my notice, I have endeavoured to attain "the last limit of simplicity" in the instrument represented in Figs. 1 and 2. The former represents the blowpipe packed for carrying in the pocket with the jet put away inside of the main tube, while Fig. 2 represents the same instrument with the jet in its place when ready for use. The main tube is a cylinder with an elliptical section, which is preferable to a circular section as the curved jet takes up considerable room in one direction, which would entail the necessity of having a circular tube of about half-diameter. This would be clumsy to carry and inconvenient to blow into. A tube, whose section is an ellipse with a major axis of half an inch, may be made quite flat, affording a small package for the pocket and a convenient mouthpiece.

In Fig. 2, representing the blowpipe as mounted for work, I have sketched with dotted lines another blowpipe

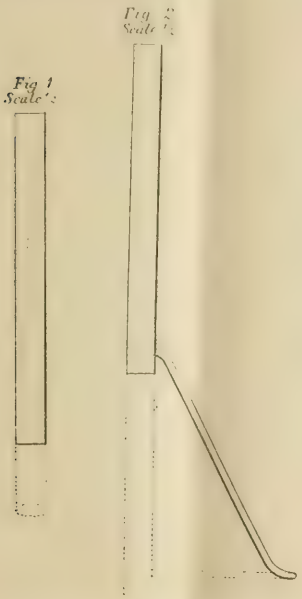
* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzehnts."

† *Bad Gew.*, 1868, 180. *Wagn. Jahresb.* for 1867, 557, and for 1868, 581.

‡ Rudorff, *Ber. Chem. Ges.*, ii., 68. *Dingl. Pol. J.*, excvi., 57. *Wagn. Jahresb.*, 1869, 588.

with a jet of the usual shape, that the portability of the new blowpipe may be appreciated, while it may be seen that in every essential quality it does not differ from the one with the full length of stem.

For the length of blowpipes Berzelius gives the distance of 8 inches from the mouthpiece to the tip of the jet, adding, however, that for every operator this distance must be such as to afford the clearest view of the substance under examination. A blowpipe similar to the one represented in Figs. 1 and 2, which I have in my possession, and whose length from the mouthpiece to the tip of the jet is 8 inches, has a main tube whose length is only 4½ inches. The relation of 4½ to 8 is a trifle less than that of Dr. Wollaston's blowpipe as given by Berzelius in the two conditions of being packed for the pocket and ready for use. This advantage is obtained by using a curved jet, which also enables the flame to take a more convenient direction than with straight but oblique jet of Dr. Wollaston's blowpipe.



If the stem of the blowpipe is made in two pieces, while the jet is made with a double curve, the length when put up for the pocket can be reduced to 3¼ inches, which gives the still smaller relation of 3¼ to 8, which I believe has never before been attained. I have one of these dimensions whose stem is formed of two conical portions with circular sections. When packed for carrying, one cone fits within the other, and the curved jet is placed inside of the inner cone. As the stem when developed is longer than when made of only one piece, the jet is shorter and less curved than that represented in Figs. 1 and 2, and it finds ample room in the inner cone. By making the two portions of the stem cylindrical, and screwing them together, a more clumsy and expensive instrument is obtained, but also one whose portions are held more firmly together.

To avoid projections on the surface of the blowpipe, the socket in which the jet is inserted is formed by a tube soldered at both ends in the interior of the blowpipe. It is indicated by dotted lines in Figs. 1 and 2. On the side of this tube a hole is pierced to allow the air to pass out into the jet.

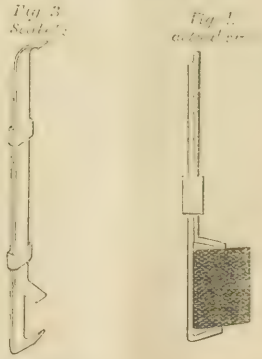
When the jet is put up in the interior of the stem, it may be wrapped up in a piece of paper to keep it from dropping out. When needed it may be picked out or shaken out.

Mouthpieces.—Extra mouthpieces of horn, wood, or ivory should be avoided, as they invariably fit loosely. Berzelius advises that blowpipes be made either of silver or tin-plate without extra mouthpiece; those made of brass are disagreeable to the mouth and leave a bad smell on the hands. Although silver is a better conductor of heat that any other substance, Berzelius tells us that he was never inconvenienced by the heating of his silver blowpipe even after very prolonged blowing.

Plating brass with either silver or nickel can only be considered as a palliative, as the nobler metal soon wears off. German silver is a very good material for blowpipes, as it is almost free from taste and smell when clean, and is a bad conductor of heat.

For blowpipes made of baser metals, mouthpieces may be made of silver and soldered on. I can propose another material which fits tightly on the stem, which is pleasant to the mouth, and which may be renewed in a few seconds at a trifling expense. This consists of a piece of rubber tubing slipped over the mouth of the blowpipe.

Charcoal Holder.—Charcoal, although one of the most necessary agents in blowpipe analysis, is also one of the most troublesome on account of its bulk, which is disproportionate to that of every other substance employed in determinations of this kind. This defect is aggravated by the circumstance that only a small portion serves as



support, while the greater part is used as a handle to keep the useful portion at a safe distance from the hand of the operator. A consideration of this and a desire of economising a troublesome agent induced me to cut up my charcoal into blocks of various sizes, about as long as they were wide, which I tried to hold before the blowpipe flame by means of tongs and forceps. Finding the use of these inconvenient, I was led to adopt the charcoal holder represented in Figs. 3 and 4, which differs from tongs and forceps in holding the charcoal from behind so that no portion of the holder comes between the charcoal and the flame, and in being able to hold the charcoal firmly without any pressure from the hand of the operator.

This holder is made of metallic strip somewhat less than ¼ inch wide, and of sufficient thickness not to bend when in use. German silver is the best material, for

reasons already pointed out. Two strips are cut about inches long, and bent in such a way that each piece has one of the jaws for holding the charcoal, and a projection for varying the distance between the jaws. After giving to each piece its proper shape they are placed in position and strapped together with two pieces of the same metal. These should not be put on too tightly, as a certain freedom should be allowed to regulate the opening between the jaws.

Clay Pipes for Support.—Fragments of a clay pipe bowl and even pieces of pipe stems held before the blowpipe flame form excellent supports for exhibiting the colours which metallic oxides afford with borax and salt of phosphorus. These fluxes, on being heated, coat the surface of the white clay with a glaze, on which may be seen the colours due to the oxidising and the reducing flames. The flux should first be melted so as to coat the white clay with a transparent colourless glaze. If now we add a substance containing copper and expose the glaze to the oxidising flame, a bright green enamel will be obtained. If now a portion of the edge of the enamel, or some other small part of the glazed surface, is touched with the reducing flame the dark red colour of cuprous oxide will be exhibited by the side of the colour due to the oxidising flame. In the same manner, with manganese, the oxidising flame will give a violet enamel, which may be decolourised in spots by the reduction flame.

The fragments of baked clay may even, to a certain degree, replace charcoal as supports to effect reductions to regulus and to exhibit some of the rings presented by volatile metals. These reactions are best shown by mixing the substance under examination with cream of tartar or one of its substitutes, such as a mixture of carbonate of soda and flour.

After being carbonised by the application of a reduction flame the mass may be triturated with water in an agate mortar. The metallic grains obtained with cream of tartar are even larger and more distinct than those obtained with carbonate of soda on charcoal. The rings exhibited by volatile metals are best seen if they are coloured, as those exhibited by lead and bismuth. White rings are not plainly seen on white clay, but may be exhibited on pieces of red or black terra cotta.

When using pieces of white clay before the blowpipe it is interesting to notice that an oxidising flame leaves the clay white, while a reduction of flame gives immediately a grey tinge which deepens as more carbon is deposited.

I have called attention to these supports as the material is always at hand and forms a great resource to a chemist who may not have either charcoal or platinum wire at hand. The pieces of clay pipe may be held in the charcoal holder already described, or with tongs or forceps, or, at the last resort, by pieces of wire conveniently twisted.

Other Supports.—When chalk is heated before the blowpipe nearly the whole of its carbonic acid is driven off, but the lime that remains keeps the shape of the chalk, and may, on account of its infusibility, be used as support to effect reductions of metallic substances and to hold cupels of bone-ash. These are made by boring cavities in the chalk, which are afterwards filled with bone-ash slightly moistened. The surface of the cupel is formed by pressing on it with the agate pestle. Berzelius recommends that cupels be made in this manner in cavities made in charcoal. I have substituted chalk for charcoal, as the latter burns away too rapidly from under the cupel. If no bone-ash is at hand a slight depression may be made on the surface of the chalk itself, and on this scorifications and cupellations may be carried on, as lime is very porous as well as infusible. As the surface of the lime cracks into little fissures it is better to heat it first and press it down with the agate pestle. Even after this has been done care should be taken to prevent loss of material by keeping a constant watch on the globule of workable lead as it dwindles down.

Another material to form supports for cupels is found in fragments of black-lead crucibles, in which cavities are easily bored. The charcoal holder before described may serve for these supports of graphite or of chalk.

Brooklyn, January 7, 1876.

PROCEEDINGS OF SOCIETIES.

PHYSICAL SOCIETY.

January 29th, 1876.

Professor GLADSTONE, F.R.S., President, in the Chair.

THE following candidates were elected Members of the Society:—Sir John Conroy, Bart., M.A., and H. T. Burls.

The SECRETARY then read a communication from Mr. J. A. FLEMING, "*On the Polarisation of Electrodes in Water Free from Air.*" The experiments described were undertaken in order to meet objections which had been raised by Prof. Rowland to a previous paper by the author, in which he endeavoured to show that when an electrolyte flows in a very strong magnetic field the electromotive force generated by its motion effects the electrolysis of the liquid—a fact which he holds to be proved by the subsequent polarisation of the electrodes. Prof. Rowland considered that the effect observed was due to the presence of dissolved air, and, conversely, that in air-free water, at any rate with the same electromotive force, similar effects would not be observed. These doubts raise the two questions—(1) In air-free water can platinum electrodes be polarised by a very small electromotive force to the same degree and with the same facility as in aërated water; and (2) is this very feeble polarisation really a decomposition of the electrolyte? To test the first point experiments were made with a voltameter containing dilute sulphuric acid, which had been previously boiled, the voltameter being connected with a Sprengel pump. The platinum plates were acted on by a very small external electromotive force for one minute, and the effect of the polarisation current due to this action noticed on an extremely delicate galvanometer, the effect of the direct current employed being also noted. After a series of observations had been made, using different amounts of electromotive force, the dilute acid was removed, and, after being thoroughly aërated, replaced in the voltameter. On repeating the experiments with this one change in the conditions, the results obtained were almost identical, from which fact the author concludes that the first question may be answered in the affirmative. With regard to the second, Mr. Fleming believes that the assertion that polarisation is decomposition of the electrolyte has never been called in question, and in proof of it describes an experiment, showing that when acidulated water flows rapidly past slightly polarised plates the current which they give is very much diminished, while by causing the water to flow slowly but slight change is produced. This seems to indicate that there is something on the plates which can be *wiped off* mechanically, and it can only be a product of electrolysis.

Prof. FOSTER, while admitting the accuracy of Mr. Fleming's experiments, doubted whether he was justified in definitely ascribing polarisation to chemical action. He thought that, even though the effect be proved not to be due to dissolved air, we must look for some cause other than chemical action; for it has long been acknowledged that the decomposition of water requires an electromotive force considerably in excess of that employed in these experiments.

Prof. GLADSTONE then made a brief communication on "*The Photography of Fluorescent Substances.*" He exhibited several photographs taken of white paper, on which devices had been previously drawn with solutions of sulphate of quinine, æsculine, &c., and one was taken in the room. He remarked that the leaves of trees come out

dark in a negative as they contain the fluorescent substance chlorophyll, and suggested that the irregularities of colour observed in photographs of oil paintings are probably due to the intermixture of fluorescent substances in the paints used.

Mr. MELDOLA referred to Prof. Vogel's experiments on the effect produced on the resulting photograph by the addition of a fluorescent substance to the collodion, thereby increasing the sensitiveness of the plate to particular rays.

Mr. S. P. THOMSON, B.A., B.Sc., then gave a summary of the recent experiments made in America by Mr. T. E. Edison, Dr. Beard, Prof. Houston, and others upon the new phase of electric manifestation—the so-called etheric force. This force is characterised by a faint spark, the only evidence in fact yet known of its existence. It may be obtained from the iron core of any electro-magnet, or from a metallic bar slipped into the coil in place of the core, but only when the battery circuit is being interrupted, as may be done by introducing into the circuit an automatic contact-breaker. The sparks so produced are apparently without polarity; devoid of chemical or physiological effect; affect neither electroscopes nor galvanometers: and are stated to be retro-active, being exhibited when one end of a wire through which they are passing is brought round to touch the wire. A detailed description was then given of experiments on this force conducted in the physical laboratory at South Kensington, some of which were confirmatory of the published researches of the discoverers, while others were at variance with them. Great pains had been taken to avoid leakage, and to distinguish the effects from those of ordinary induced currents. The batteries and coils employed were insulated from the earth as well as from the other portions of the apparatus. A bar of zinc placed above the poles of a powerful electro-magnet, or within its coils, was found to give better results than one of cadmium, which is recommended by the discoverers. The sparks, which resembled those of dynamic electricity, were of inappreciable length, and far too faint to ignite gun-cotton, or illuminate a delicate Geissler's tube. It was also found that when a bar of zinc was placed within the coil of an electro-magnet in the place of its core, and joined by a wire to the gas-fittings of the building, faint but distinct sparks could be drawn from any portion of this wire by a second wire proceeding from another part of the gas-pipes. Another peculiar effect was observed when the wire attached to one end of the zinc bar, and armed at its extremity with a thin iron wire, was rubbed lightly against the other end of the zinc bar, sparks being thus obtained, apparently passing from one pole of the zinc bar, through the wire, to the other.

Dr. STONE believed he had detected a distinct galvanic taste on applying to the tongue the wire through which the "force" was passing.

Prof. FOSTER suggested the use of an electro-dynamometer to ascertain the electromotive force of the current exhibiting these sparks, as its indications would be independent of direction of current.

GLASGOW PHILOSOPHICAL SOCIETY.

(CHEMICAL SECTION).

Ordinary Meeting, January 17th, 1876.

Professor JOHN FERGUSON, M.A., President, in the Chair.

PROFESSOR DITTMAR, F.R.S.E., submitted three communications from the chemical laboratory of Anderson's University. The first was by Messrs. Dittmar and D. R. Stewart, and was entitled "*Notes on Aqueous Alcohols.*" In the course of an investigation on the vapour-tension and other physical properties of allyl alcohol and on the propyl alcohol, which they started some time ago, the authors were led to study somewhat minutely the comportment on distillation of aqueous allyl alcohol, and the results they arrived at induced them to extend their experiments to aqueous ethyl and methyl alcohol. The paper laid before the section embraced the results of this collateral inquiry. It dealt first with allyl alcohol, and gave an account of the means taken for the purification of the crude products. 500 grms. of glycerin, 125 grms. of crystallised oxalic acid, 1 grm. of sal-ammoniac, and 1 grm. of common salt were mixed and subjected to slow distillation. The fraction coming over between 195° and 260° was taken as containing the allyl alcohol, and was rendered alkaline with caustic soda and boiled, small additional quantities of the alkali being introduced from time to time so as to maintain an alkaline reaction; and this operation was continued until the mixture remained alkaline after several hours' boiling. The acids originally present as such, or as ethers, having thus been rendered non-volatile, the mixture was distilled, and from the distillate the allyl alcohol separated out by fractional distillation, and treatment of the proper fractions with dry carbonate of potash. The crude alcohol thus obtained is contaminated mainly with water and acroleine. Acid sulphite of soda was used to eliminate the latter, the distillations being continued until the specific gravity of the alcohol remained constant at 0·8576 at 15° (water of 15·5° = 1). The authors persevered with the resulting product, and in the course of their attempts to pass from a nearly anhydrous to really absolute allyl alcohol, they were struck by the obstinacy with which this alcohol retained the last remnants of water, and more still by the observation that the boiling-point rose as the dehydration progressed. The latter observation led to the institution of a series of distillation experiments with synthetically prepared aqueous alcohols of known strengths. (The results of these distillation experiments, and others involved in the paper, were recorded in a series of very elaborate tables, which will be published in the *Proceedings of the Philosophical Society of Glasgow.*) From the numbers given in the first table, it appeared to the authors that there must be a certain aqueous alcohol,—

$$C_3H_5.OH + pH_2O^*$$

(where p is an unknown number situated between 1 and $\frac{3}{4}$), which, under ordinary barometric pressure, boils constant at a certain temperature not far removed from 88°; and that all aqueous allyl alcohols behave as if they were mixtures of this pseudo hydrate and water or allyl alcohol. Proceeding to methyl alcohol, the authors eventually obtained a product of the specific gravity of 0·7981 at 15·4° (water of 15·5° = 1), and they felt themselves justified in assuming it to be anhydrous. The numbers given in the table referring to the second series of experiments showed that if there be an aqueous methyl alcohol which boils at a lower temperature than the alcohol itself, its percentage must be very close to 100. The boiling-point of pure methyl alcohol, according to the observations of the authors, is 65·1°, *i.e.*, 0·9° less than the generally adopted value of 66°. Dupré's alcohol must have been largely contaminated with aceton. From the numbers given by the authors in the table referring to their experiments with ethyl alcohol, it appeared that the boiling-point of all aqueous alcohols containing less than 28 per cent of water lies within the narrow range of from 77·4° and 78·0°, and that the minimum corresponds to about 5 per cent of water. This is quite in agreement with an old observation of Sömmering's,† according to which, when an almost absolute alcohol is distilled, the distillate is weaker, and the residue always stronger, than the original mixture.

The second paper read by Prof. DITTMAR was "*On Perbromic Acid,*" by Mr. R. W. E. MACIVOR, a full abstract of which has already appeared in the CHEMICAL NEWS.

The concluding paper was by Prof. DITTMAR himself, its title being "*On a New Method of Assaying Chrome-Iron Ore.*"

* $C_3H_5O.\ H_2O$ corresponds to 23·7 per cent of water.
$C_3H_6O.\ \frac{1}{2}H_2O$ " " 31·3 " "

† This important observation is entirely ignored both by the English and by the second and third editions of the German "Dictionary of Chemistry."

CORRESPONDENCE.

RAPID FILTRATION.

To the Editor of the Chemical News.

SIR.—The problem of effectual and rapid filtration has frequently, and with useful effects, been discussed in your columns. One of the latest suggestions, which attracted attention, was that of Carmichael, who proposes to use, instead of the ordinary conical funnel, one with a bottom almost flat, to which is adapted a piece of perforated platinum foil. On this is placed a *flat* disc of filter-paper, just sufficiently large to cover the bottom of the funnel. The advantages claimed are—that the filtration is conducted more rapidly, that the filter-paper is much smaller, and that the risk of tearing the filter is obviated.

In order to test the relative merits I connected a funnel of each description with a filter-pump which maintained a vacuum of about 5 inches of mercury. The filters used were of Swedish paper, the ordinary one being 5 inches in diameter, that for Carmichael's funnel 1¼ inches.

On testing with water only, Carmichael's funnel was the more rapid in its action, 6 ounces of water running through it in a minute, while 2 minutes 20 seconds were required by the other. When, however, precipitates were introduced the advantage in every case was not so marked. When filtering crystalline precipitates, such as ammonic magnesic phosphate, &c., the new arrangement was found the more effective, as the filtrate passed through the paper readily. But on the introduction of gelatinous substances, such as ferric hydrate or phosphate, after a very short time the filtration ceased almost entirely. On examination it was found that the precipitate was collected on the surface of the paper in a compact layer, which was almost impervious to the filtrate. The filtration was not helped by a more perfect vacuum, for with one of 12 or 15 inches of mercury the operation was not hastened. In these instances the ordinary filter was found more effectual. This same action, however, seems in other cases to be beneficial, as the precipitate is thus obtained in a closer and denser mass, and is drained almost dry in a few minutes. It was also observed that, in experimenting on finely divided precipitates, such as plumbic chromate, the filtrate passed through clear in a shorter time than usual, the layer of precipitate on the surface of the paper itself probably assisting the more complete filtration. The quantity of washing water necessary is considerably less with Carmichael's filter, as the whole quantity used acts directly on the precipitate itself. This not only effects a saving of time, but in the case of slightly soluble compounds a source of loss is much lessened.

It may, then, be inferred from the preceding observations—

(1.) That crystalline and granular precipitates filter more rapidly, and can be washed to greater advantage, by using a Carmichael funnel.

(2.) That bulky, and especially gelatinous, precipitates are filtered more expeditiously through an ordinary funnel, with a platinum cone.

—I am, &c.,

WILLIAM JAGO.

Royal College of Chemistry, South Kensington, S.W.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences. No. 2, January 10, 1876.

Spectrum of Gallium.—M. Lecoq de Boisbaudran.—Inserted in full.

Union of the Carbides of Hydrogen with the Hydracids and the Halogens.—M. Berthelot.—The author describes his methods of experimenting, and states the amount of heat evolved.

Causes of Failure in the Detection of Minute Quantities of Iodine.—M. A. Chatin.—The following precautions are necessary in the detection of iodine in a common potable water:—It is needful to precipitate the soluble salts of lime and magnesia with an excess of pure carbonate of potassa. The iodine being thus fixed will be found in the residue after evaporation, which is slightly ignited to destroy organic matter. The liquid must be separated by decantation from the earthy carbonates, which will be deposited during the first quarter of the evaporation. Towards the end of this process the heat must be diminished to avoid any loss of the soluble residue by spirting. This last point is important, as the iodide is among the last drops evaporated. The excess of carbonate remaining after the precipitation of the calcio-magnesian salts should be the larger the more organic matter is present. We may ascertain that this excess has been sufficient, either by the residue appearing colourless after calcination, or by the circumstance that although coloured it forms a paste if treated with alcohol at 90 per cent. If the alkaline carbonate has been insufficient the residue will be divided in the alcohol, like a powder; the iodine then escapes in great part, or entirely during calcination. The alkaline residue left on the evaporation of the water is repeatedly (generally three times) treated with alcohol, and the solutions are mixed together in a capsule capable of holding at least four times the quantity. Before proceeding to evaporate, which must be done at a low temperature, the alcohol is mixed with about half its volume of pure distilled water. The water should have been distilled after an admixture with carbonate of potassa. Frequent agitation is useful. Slight calcination is again needed to destroy a certain quantity of organic matter which has escaped the former ignition, and the presence of which would mask the characters of traces of iodine. The residue at the bottom of the capsule should be colourless and scarcely perceptible. If it is very appreciable in quantity too much alkaline salt is present, and it must be re-dissolved in alcohol. The last condition is that this residue must be dissolved in a minimum of water, two drops, or even a single drop, which must be led over the bottom of the capsule with a glass rod, so as to dissolve all the iodide present. With the end of the stirrer this liquid is divided into three or four portions, one of which—which will give the most distinct reaction—being left in the bottom of the capsule, the others being placed on fragments of porcelain. One of these little drops is mixed with chloride of palladium; the others, having first received a trace of recent starch-paste, are carefully touched, the one with nitric acid, the other with commercial sulphuric acid; chlorine water only gives the blue colouration if the quantities are more considerable. A common cause of failure is the use of chlorine water, and of two dilute solutions. Earths, ores, metals, sulphur, &c., are first finely divided, and then boiled in a solution of carbonate of potassa, which is then treated as above. It is well to make blank experiments along with researches of this kind.

Influence of Temper upon Magnetisation.—M. J. M. Gaugain.—The ingots of steel which have received the hardest temper take the strongest magnetisation when powerful sources are employed.

Sanitary Use of Ozone.—M. Carvalho having presented to the Academy a model of a machine for ozonising the air of rooms in unhealthy climates, M. P. Thenard pointed out the dangers which may result from the random and unprofessional use of an agent by no means fully understood.

Researches on Aldehyd.—M. Berthelot.—A thermo chemical study, the heat evolved being measured by the transformation of aldehyd into acetic acid.

Moniteur Scientifique, du Dr. Quesneville, January, 1876.

History of the Manufacture of Turkey-Red.—Theodore Chateau.—This paper, so far, has a merely historical interest.

Chemical Products at the Vienna Exhibition.—M. E. Kopp.—A catalogue of the exhibitors of colouring matters with the articles shown.

Recent Progress in Industrial Chemistry.—This paper consists of extracts from Dr. Hofmann's "Report," now appearing in the CHEMICAL NEWS.

Account of Memoirs Published in the Berlin "Berichte."—M. Adolph Baeyer.

Notices of Laboratory Apparatus.—M. A. Gueront.—These notices require the accompanying figures.

Violet Ultramarine.—M. Robert Lussy.—Already noticed.

The remainder of this issue is taken up with papers from the Berlin *Berichte*, *Comptes Rendus*, and *Journal of the Chemical Society*.

Les Mondes, Revue Hebdomadaire des Sciences, No. 2, January 13, 1876.

This issue contains no chemical matter.

No. 3, January 20, 1876.

Apparatus for Distilling Sulphuric Acid.—MM. Faure and Kessler.—This apparatus is composed of a wide shallow platinum cistern, covered with a cap of lead with double walls, between which circulates water, so as to keep the cap at a moderate temperature. The edges of the cistern are connected with the leaden cap by a hydraulic joint, and the two metals do not come in contact. On the one hand the cistern receives through a leaden tube acid at 60° from a preparatory concentrator; and on the other, it delivers acid at full strength through a pipe of platinum. Thirty-nine of these arrangements are already in operation in twenty-six sulphuric acid works.

MISCELLANEOUS.

Average Composition and Quality of the Metropolitan Waters in the Year 1875.—The following are the returns of the Society of Medical Officers of Health:—

Names of Water Companies.	Total Solid Matter per Gall.	Oxygen required by Organic Matter, &c.	Nitrogen.		Hardness	
			As Nitrates, &c.	As Ammonia.	Before Boiling.	After Boiling.
	Grs.	Grs.	Grs.	Grs.	Deg.	Deg.
Thames Water Cos.						
Grand Junction ..	19·78	0·084	0·146	0·002	14·9	3·8
West Middlesex ..	19·32	0·044	0·146	0·000	14·5	3·6
Southwark and Vauxhall	19·89	0·082	0·151	0·002	14·8	3·8
Chelsea	19·59	0·077	0·142	0·001	14·8	3·8
Lambeth..	19·78	0·085	0·150	0·001	14·8	3·8
Other Companies.						
Kent..	28·03	0·007	0·306	0·000	20·9	5·9
New River	19·06	0·030	0·147	0·000	14·5	3·4
East London.. ..	20·70	0·046	0·172	0·001	15·1	3·9

Note. The amount of oxygen required to oxidise the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours, and in the case of the metropolitan waters the quantity of organic matter is about eight times the amount of oxygen required by it.

The water was found to be clear and nearly colourless in all cases but the following, when it was slightly turbid—viz., in the case of all the Thames Companies except the West Middlesex. These results are the averages of the analyses of the samples of water taken monthly from the mains of the several companies during the year, and they show that the total proportions of solid matter dissolved in the water have been as follows—namely, 19·67 grains per gallon of the Thames supply, 19·06 grains of the New River supply, 20·7 grains of the East London supply, which is chiefly from the Lea, and 28·03 grains per gallon of the Kent Company's water, which is obtained from deep wells in the chalk. The solid matter consists, in all cases, of a very large proportion (about two-thirds of the whole) of carbonate of lime, with a little carbonate of magnesia; and the other third is composed, in nearly equal parts, of sulphate of lime, common salt, and nitrate of magnesia. These substances, in the proportions in which they exist in the metropolitan supply, are of prime importance in a dietetical and sanitary point of view; for experience has shown that waters of a moderate degree of hardness, from the presence of calcareous salts, are more wholesome than those which are deficient of such substances. It is satisfactory, also, to know that the water supplied to the metropolis is remarkably free from organic pollution—the nitrogen, for example, which is present as actual or saline ammonia, does not exceed the 0·002 part of a grain per gallon of water; and in several cases, as in Kent, the New River, and the West Middlesex Companies' water, it is entirely absent. So also with regard to organic or albumenoid nitrogen, the proportion is exceedingly small—averaging, in the case of the Kent Company's water, the 0·003 of a grain per gallon; in the West Middlesex and New River Companies' Water, the 0·004 of a grain; in the East London water, the 0·006 of a grain; and in the rest of the companies', the 0·007 of a grain. Nitrogen, as nitrates, ranges from 0·147 of a grain per gallon of the water derived from the Thames, to 0·306 of a grain in the deep-well waters from the chalk. All these facts, together with the small proportion of alkaline chloride in the water, indicate a remarkable freedom from sewage or other organic pollution; and they fully sustain the high opinion entertained of the wholesome quality of the water supplied to London, as expressed in the reports of the scientific commission of 1850, the select committee of the House of Commons, 1867, and the Royal Commission on water supply in 1869, all of whom were specially appointed to investigate the quality of the water supplied to this metropolis. There is, moreover, a remarkable uniformity and constancy of the quality of the water supplied to London. Taking the last five years as an illustration of this, it will be found that the total amount of solid matter in the Thames supply has ranged from a yearly average of 17·98 grains per gallon to 19·67; in the New River water the range has been from 18·52 grains per gallon to 19·22; in the East London from 18·85 grains to 20·74; and in the Kent Company from 27·21 grains per gallon to 28·17. The same is the case with the individual constituents of the water, the most important of which show no sign of increase, but rather of decrease, in their proportions from year to year. If, therefore, in 1867 the select committee of the House of Commons were, as they reported, "satisfied that both the quantity and quality of the water supplied from the Thames is so far satisfactory that there is no ground for disturbing the arrangements made under the Act of 1852, and that any attempt to do so would end in entailing a waste of capital, and an unnecessary charge upon the owners and occupiers of property in the metropolis," there is manifestly still greater reason to be satisfied with the quality of the water at the present time, when with more refined processes of chemical analysis it is found that the water is yearly improving. This will be more evident when the turbidity observed in the water supplied by some of the Thames companies is effectually removed by improved methods of storage and filtration. The quantity of water daily supplied to the metropolis has ranged from 31·9 gallons per head of the population to 36·9 gallons, the average for the whole year being 33·7 gallons per head per diem. Month by month the proportions have been as follows:—

1875.	Gallons Delivered.	Houses Supplied.	Gallons per Head, Daily.
January ..	118,339,776	515,292	31·9
February ..	104,547,033	515,346	32·2
March	109,352,343	516,514	32·2
April	113, 45,907	517,200	32·8
May	121,543,736	517,489	35·3
June	127,381,916	518,127	30·9
July	122,319,088	519,063	35·5
August	125,180 742	519,569	36·3
September ..	117,744,887	521,068	34·2
October	117,744,907	521,068	34·2
November ..	109,998,771	521,336	31·9
December ..	111,420,340	521,566	32·3
Average ..	116,138,787	518,606	33·7

About half of the water is derived from the Thames, about one-third from the New River and the Lea, and the rest from deep wells in the chalk. The largest proportion of it, amounting to about 80 per cent., is used for domestic purposes, and, considering the requirements of a household, a daily supply of 26·8 gallons per head of the population, or about 180 gallons per house, is abundantly sufficient for all domestic and sanitary purposes.

H. LETHEBY, M.B.

Brown Crystals of Calcite.—Dr. Phipson writes us:—"In the white quartz which accompanies the talcose schist on the Clyde, I have foundin the neighbourhood of Helensburgh some very curious dark liver-coloured calcite imbedded in the quartz. The crystals are not perfect and isolated, but present the usual cleavage. On dissolving in very dilute acid this calcite leaves about 5 per cent of a brown residue consisting chiefly of oxide of manganese. Although this quantity of foreign matter is intimately mixed up with the carbonate of lime, it does not (except by colour) affect its usual brilliant crystalline appearance. In my opinion this oxide of manganese (which contains some peroxide of iron) has been derived from carbonate of manganese that has crystallised originally with the carbonate of lime. How has this *carbonate* of manganese been transformed into *oxide* whilst the carbonate of lime is not affected—unless by superheated steam or water under pressure?"

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

An improved process for the distillation of alcoholic spirits, by which alcohol, free from fusel oil, is produced by a single distillation, also including an improved distilling apparatus adapted therefor, and an improved method of reducing the proof of spirits in order to produce whiskey. R. C. Brooks and A. J. Van Winkle, San Francisco. December 8, 1874.—No. 4209. This invention relates to an improved process for producing by a single distillation alcoholic spirits which are free from ether and fusel oil, and also in an improved apparatus or still for accomplishing said distillation, which is termed by the inventors a "low temperature pulsating still." This improved process consists in a modification of the ordinary process of fractional distillation which is used by chemists in the analysis of substances. This process is followed as far as it serves to eliminate the ether and alcohol separately from the wort and still, but at this point the ordinary process of fractional distillation is diverged from, by allowing the water and fusel oil to remain in the wort and be withdrawn from the still without being volatilised. Ether is one of the volatile extracts of wort, or the fermented solution from which spirits are obtained: vapourises at the low temperature of 173 F. Alcohol vapourises at 180° F., and water at 212° F., while fusel oil is not converted into a vapour at a temperature less than about 269 F. These substances are the volatilisable portions which are obtained from wort by heating it in a still, and as the alcohol is the portion which it is desirable to obtain free from the remaining volatile portions advantage is taken of the difference or space of temperature which exists between their vapourising points, to first volatilise and eliminate the ether both from the wort and still, and thus uncover the alcohol which will volatilise at the next highest temperature. The alcohol is then converted into vapour by applying a heat which will volatilise it and send it into the worm of the still and into the condenser without being high enough to vapourise either the water or fusel oil in the wort; and the result is that alcohol is obtained free from water and fusel oil, excepting only as much of the water as the alcohol vapours carry off in solution, which is usually just about sufficient to reduce the condensed alcoholic vapours to proof spirits. The alcohol portion being thus obtained independent of the ether and fusel oil, the wort is withdrawn from the still as spent wort and replaced with a fresh charge. The process may be carried out using any ordinary still, but for convenience the inventors have devised what they term a "low temperature pulsating still." The arrangement of this improved still is such that the temperature of each part is automatically regulated and prevented from exceeding the limit required to vapourise, condense, and separate each of the products successively in the order in which they are converted into vapour; and it is called a pulsating still because, as each fresh charge of wort is introduced into the heating-chambers of the still, the temperature of the condensing and separating apparatus falls back or recedes by the automatic operation, so that the distillation of each separate charge forms a separate complete operation, beginning at a fixed low temperature, and increasing to the maximum temperature until the distillation is complete.

Improvements in the method of and apparatus for smelting or extracting iron, copper, or other metals from their ores. R. Stone, Liverpool, Lancaster. December 14 1874.—No. 4238. This invention has for its object, first, the utilisation of the waste and inflammable gases given off during combustion in the furnace or cupola used for the smelting of metals. The waste gases are brought down through suitable pipes or flues from the mouth of the furnace or cupola (where they are emitted), and returned to the bottom of the furnace either separately by a distinct exhaust and blowing apparatus for that purpose, or in combination and connection with the ordinary blast-pipe or pipes. Secondly, The introduction of steam separately into the furnace, or in combination with the return waste gases, or in combination with gases generated by heat from any of the known salts that give off oxygen. Thirdly, The introduction of a spray, jet, or jets of hydrocarbon oil or spirit into the furnace, either in combination with a jet or jets of steam, or cold or heated atmospheric air, or separately. Fourthly. The utilisation of the said waste heat and gases arising from the furnace or cupola for heating a chamber or pipes through which pass the blast-pipes of the furnace or cupola. Fifthly, Apparatus and arrangement of same for carrying the before-mentioned method into operation.

An improved method of treating curried or dressed leather cuttings and waste so as to obtain valuable products. M. Murphy, Liverpool, Lancaster. December 17, 1874.—No. 4355. This consists—First. In treating the leather waste or scraps in a liquid or gaseous bath of hydrocarbon or other suitable oil or solvent to remove the animal or vegetable oils or fats. Second. In distilling and condensing the product left by the treatment described under the first part so as to separate the solvent from the oils or fats.

NOTES AND QUERIES.

Commercial Analysis of Phosphates.—Will some corresponden be kind enough to explain the method of determining the percentage of phosphate of lime in insoluble precipitated phosphate calcined?—AGRICULTURIST.

MEETINGS FOR THE WEEK.

MONDAY, Feb. 7th.—Medical, 8.
—— London Institution, 5.
—— Royal Institution, 2. General Monthly Meeting.
—— Society of Arts, 8. Cantor Lectures. "Iron and Steel Manufacture," by W. Matthew Williams, F.C.S.

TUESDAY, 8th.—Civil Engineers, 8.
—— Photographic, 8. (Anniversary.)
—— Royal Institution, 3. "On the Classification of the Vertebrated Animals," by Prof. Garrod.

WEDNESDAY, 9th.—Society of Arts, 8. "The Cultivation of Hardy Fruits, with a View to Improvement of Quality and Ensuring Constant and Abundant Production," by Shirley Hibberd.

THURSDAY, 10th.—Royal, 8.30.
—— Royal Institution, 3. "On the Chemistry of the Non-Metallic Elements," by Prof. Gladstone.
—— Mathematical, 8.
—— London Institution, 7.

FRIDAY, 11th.—Royal Institution, 9. "Mechanical Action of Light," by William Crookes, F.R.S.
—— Astronomical, 3. (Anniversary).
—— Quekett Microscopical Club, 8.
—— Society of Arts, 8. Chemical Section. "Sole-Leather Tanning, with some Remarks on the Import of Hides and Cattle," by Sparke Evans.

SATURDAY, 12th.—Royal Institution, 3. "On the Vegetable Kingdom," by W. Thiselton Dyer.
—— Physical, 3.

TO CORRESPONDENTS.

T. Birdsall.—We do not know. You will probably obtain the information by advertising.

T. S. Kipp.—We believe the process is patented in England. A reference to the Patent Office Library will give the desired information.

W. B.—You can obtain it from any large operative chemist.

THE CHEMICAL NEWS.

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CRYSTALLISED GLYCERIN.

By DR. PAUL F VAN HAMEL ROOS.

According to an observation of Wöhler in 1867, the glycerin seems to get in the solid state by exposing it continually to movement at a low temperature.

As I have had the opportunity of experimenting on crystallised glycerin I beg to call attention to the following points:—

It seems that the glycerin only by being in the highest state of chemical purity can be solidified.

When this chemically pure and perfectly anhydrous crystallised glycerin is melted and afterwards exposed to a temperature of 30° F., the smallest crystal of crystallised glycerin transforms all the liquid again in a solid body.

If the temperature is 24° F. the transformation is *spontaneous*, *i.e.*, without putting any crystal into the melted glycerin it gets solid by stirring the liquor vigorously. The sp. gr. of this glycerin is at its melting-point 63° F. 1·261.

When this glycerin is exposed to the action of hydrocyanic acid no alteration in the colour can be observed after several weeks.

If it is mixed with yeast and exposed to a temperature of 70° F. to 80° F. no fermentation results (after two or three weeks of contact). Prof. Redtenbacher describes such a fermentation, with propionic acid as one of the results. No acid has been observed in the mixture of glycerin and yeast. If a glycerin contains one-tenth per cent of water or more, the solidification is impossible.

The crystals of glycerin seem to have a prismatic form, but it is very difficult to undertake crystallographic measurements, the melting-point being so low and the crystals very small. I am trying to get bigger crystallisations, and I hope to be able to mention soon some other experiments about this rare material.

Stirling Chemical Works, Stratford, E.,
February 2, 1876.

NOTE ON THE PREPARATION OF METALLIC TITANIUM.

By SERGIUS KERN, St. Petersburg.

In many manuals of chemistry it is proposed to prepare this metal by the ignition of metallic potassium or sodium with the double fluoride of titanium and potassium (TiK_2Fl_6). The titanium obtained by this process in the form of a grey powder decomposes water very easily at 100°; but experiments proved that the titanium obtained by this method always contains an excess of unoxidised potassium or sodium, and the presence of these metals explains well why the titanium decomposes water at such a low temperature.

By the following method analogous to the production of metallic silicon titanium is very easily prepared:—

Through a tube with a bulb in the middle of it in which sodium is melted, vapours of titanium tetrachloride are passed. Then by the following reaction titanium is obtained:—

$$TiCl_4 + 4Na = Ti + 4NaCl.$$

The mixture of titanium and sodium chloride is washed by means of cold water; the remaining precipitate of titanium is washed with ethyl-ether and dried over sulphuric acid. Titanium carefully prepared by this process has no action on water at 100° and only decomposes it at about 500°.

REPORT ON THE DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 50.)

II. *Cold from Spontaneous Evaporation.*

Liquids capable of forming vapours require, as is well known, for their transformation into the gaseous or aëriform state, considerable quantities of heat, which are necessary to maintain them in that condition. The heat of evaporation is not indicated by the thermometer, and is therefore often spoken of as combined heat in contradistinction from the so-called free heat which acts upon the thermometer and determines temperature. The combined heat of different liquids varies greatly; that of water, *e.g.*, at a temperature of evaporation = 34°, amounting to 58·3 heat-units, whilst that of an equal weight of ether evaporating at the same temperature is only 90.

In the process of evaporation liquids are compelled to draw their supply of heat for evaporation in the first place from their own store of free heat. In consequence the temperature sinks. As, however, heat is conveyed from without to every substance whose temperature is lower than that of its surroundings, and as this influx is the more rapid, the greater the difference of temperature the cooling process is not without its limits. A state of equilibrium is attained as soon as at a certain reduction of temperature the loss of free heat caused by continued evaporation is compensated by the access of heat from without.

The depth of the lowest temperature of an evaporating liquid is more or less dependent on external circumstances. This point is, however, in all cases reached the more readily because as the temperature of evaporation falls the tension of the vapour, and at the same time its density and its quantity, decrease. The volume, *e.g.*, of 1 cubic metre, which, at 34°, can be filled with 37·25 grms. of saturated watery vapour, admits, at 0°, only 4·76 grms., and at −10° only 2·29 grms. Hence it is perfectly plain that at −10°, circumstances being otherwise unaltered, evaporation proceeds much more slowly, and consequently the accession of heat from without must have a greater effect than at 34°.

The case is similar with other liquids, but so, in general terms, that those evaporate most rapidly which, at a given temperature of evaporation, possess the greatest maximum tension, or, what amounts to the same thing, those whose boiling-point lies lowest. Thus, if ether evaporates spontaneously, the volume of 1 cubic metre contains at 34°, 3750 grms.; at 0°, 1515 grms.; and even at −10°, 654 grms. of vapour; whilst at this temperature water yields only 2·29 grms. The much lower latent heat of the vapour of ether is, as we see, amply compensated by the far greater weight of the mass that evaporates under equal conditions. Thus the strong cooling power of evaporating ether is easily intelligible.

Still more striking in this respect are liquid sulphurous acid and liquid ammonia, whose boiling-points are respectively −10° and −33°.

The intensity of the cooling of an evaporating liquid is greatly augmented by cutting off, as far as possible, the accession of heat from without. This is effected, of course, by the use of coverings which conduct badly. On the other hand an attempt is made to remove influences which interfere with the speed of evaporation. An essential point is removal of the external atmospheric pressure, since the air opposes a mechanical hindrance, not, indeed, to the formation of the vapour rising from any liquid, but to its rapid dispersal. Hence a given

* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzehends."

space, for whose perfect repletion with saturated vapour several minutes would not suffice, is almost instantaneously saturated if the air be withdrawn.

For the removal of the air a good air-pump is in most cases employed. The air-pump alone as a promoter of evaporation would, however, in general, prove insufficient, since its action is not powerful enough to remove the vapours with the same speed as they are produced in a space free from air. But the evaporation is completely interrupted as soon as the given space is filled with vapour of the same temperature at which the evaporation goes on. This purpose of a speedy removal of the vapours arising from an evaporating liquid is satisfactorily effected by their absorption; thus the vapour of water is removed by means of concentrated sulphuric acid.

(To be continued.)

ON A READY MEANS OF DETECTING ARSENICAL COMPOUNDS.*

By EDMUND W. DAVY, M.A., M.D.
Professor of Forensic Medicine, Royal College of Surgeons, Ireland

THE extensive employment of certain compounds of the metal arsenic for the criminal destruction of human life has rendered their detection under different circumstances a matter of great importance to society, and to attain this end they have long been objects of much interest to the chemist and toxicologist. Fortunately for mankind, the metal itself, as well as its combinations, have been found to be endowed with very characteristic chemical properties, and on these are based several excellent tests, by which, in the hands of the chemist or in those skilled in the detection of poisons, very minute quantities of arsenic or of its compounds can be identified with more or less facility; and the fear of such detection has acted as a great preventative against their criminal employment as poisons; for, before such means of recognising their presence were discovered, secret poisoning by arsenious acid —which is popularly known as "arsenic"—was carried on to a fearful extent, a greater number, perhaps, of individuals having been already deprived of life by that substance than by all the other known poisons put together. But now, owing to our possessing the means by which even very minute quantities of arsenical compounds can be detected with almost unerring certainty, and there having been of late years certain legal restrictions placed on the sale of arsenic, cases of homicidal poisoning by that substance have become comparatively rare. Still, as such cases or those from accident do from time to time occur, and as different arsenical compounds are used for a number of industrial purposes, some of which are highly objectionable, endangering as they do the health, and even lives, of many individuals, it is very desirable that we should be able readily to detect those virulent substances, not only where they may occur by design or accident in different articles of food or drink, or in the bodies of those who have died from their effects, but likewise where they may exist in various manufactured products, the use of which might be attended with very serious consequences. The test which I would now propose, being one of such simplicity and ease of execution that it might be performed by almost any one, will, I should hope, be found useful for the objects stated, especially to those who are not very conversant with the details of chemical manipulation. As it is a modification of Mr. Marsh's test, it is necessary for me briefly to refer to that method before describing the one I would now suggest. That gentleman's test, as is well known, is founded upon the circumstance that nascent hydrogen in presence of certain compounds of arsenic will give rise to the formation of arseniuretted hydrogen,—a gas which, being possessed of very characteristic properties, may be easily recognised, and thus very minute quantities of arsenic under different circumstances can be readily detected. This method, as proposed by its discoverer, consists in generating, in a suitable apparatus, hydrogen by the action of dilute sulphuric acid on metallic zinc, and then adding in the state of solution the arsenical compound, when arseniuretted hydrogen will be quickly generated, and a fine jet of the gas being ignited, and a cold surface placed down on the top of the flame, very characteristic spots or stains of metallic arsenic will be produced; or the gas being passed through a heated tube, it will be decomposed, and a metallic sublimate formed at a short distance beyond the heated portion. I need not refer to the apparatus recommended by Mr. Marsh for carrying out his test, as it is now so well known, nor to the modifications of it which have been subsequently proposed; and I must acknowledge that this beautiful means of detecting arsenic, owing to its great delicacy and very conclusive results in the hands of the experienced chemist, leaves but little to be desired. It, however, labours under this serious disadvantage, that the acid and the zinc which are employed in the process may one or other of them, or even both, contain more or less of arsenic as an impurity, and consequently the indications of that substance which are thus obtained may be due not to its existing in the suspected matter or object under investigation, but to its occurring as an impurity in the materials employed in this process for its detection; and I may add that it is difficult to get in commerce the zinc and sulphuric acid required perfectly free from arsenic.

To obviate more or less this source of fallacy several modifications of the original process of Marsh have been suggested. Thus Fleitmann, some years ago, proposed the use of a strong solution of caustic potash, assisted by heat, instead of the acid, to act on the zinc as a means of generating the hydrogen gas, and in this way one source of arsenical contamination was avoided. It was found, however, to be too slow a means of generating hydrogen to detect arsenic in the usual way by Marsh's method. Prof. Bloxam has suggested the employment of a galvanic battery for the generation of the same gas, and in this way obviates the use of zinc, and thus excludes another possible source of fallacy; but, owing to the trouble and expense attendant on the use of a galvanic battery, which for this purpose must be of some power, and the arrangement being of rather a complicated character, and still requiring sulphuric acid, it has, I believe, been but little employed. I should also add that the metal aluminium, and more recently magnesium, have been proposed as substitutes for zinc in Marsh's process or in Fleitmann's modification of it, as being less likely to be contaminated with arsenic than that metal. The modification which I would now suggest, and which, as far as I can ascertain, has not hitherto been proposed, is the employment of an amalgam of sodium and mercury as a means of generating the hydrogen required for the test; and by the use of this substance I do away with, altogether, the necessity of any acid, and I employ two metals which are not liable to arsenical contamination. As to sodium, I am not aware that arsenic has ever been pointed out as one of its impurities; and as to its presence in mercury, that is, I believe, a circumstance of very rare occurrence; but, should it exist in that metal as an impurity, it can be readily removed from it by digesting the mercury in diluted nitric acid, and afterwards well washing it with water. The amalgam which I have found to answer very well for the detection of arsenic consists of 1 part by weight of sodium to 8 or 10 parts of mercury, and is easily made by heating moderately in a test-tube over a lamp the mercury, and then adding gradually in small pieces the sodium, taking care to keep away the face, if unprotected from the mouth of the tube, lest some of that metal in an ignited state might be spirted out during the addition of the first portions. Those metals readily combine under these circumstances, forming an alloy that is liquid whilst hot, but

* A Paper read before the Royal Irish Academy.

becomes hard and brittle when cold. The contents of the tube, while still hot and liquid, are quickly poured out on a clean plate, and, when cool, broken up in small lumps, which are then immediately placed in a well-corked or stoppered bottle.

The way I employ this amalgam is simply to place the suspected solution, or solid matter along with a little water, in the bottom of a test-glass; then add a small bit of the amalgam, about the size of a grain of wheat; and lastly, place without delay, on the top of the glass, a piece of white filtering-paper or the cover of a white porcelain crucible moistened with a drop of a dilute solution of nitrate of silver, slightly acidulated with nitric acid, when—if arsenic is present—a dull black or deep brown stain on the paper, or a dark silvery one on the porcelain, will be quickly developed in the part moistened, owing to the silver of the salt being reduced to the metallic condition by the agency of the arseniuretted hydrogen thus evolved, which, coming in contact with the nitrate of silver, gives rise to the following reaction :—

$$H_3As + 6AgNO_3 + 3H_2O = 6HNO_3 + H_3AsO_3 + 3Ag_2.$$

The silver solution, which I have found to answer very well for this purpose, was made by dissolving 20 grains of the nitrate in an ounce of distilled water, and then adding 2 drops of strong nitric acid, to render the solution slightly acid. I may further add that I generally place a small disc of bibulous paper between the mixture in the glass and the paper or cover moistened with the silver solution, to intercept any particles of the liquid which might otherwise be projected against them, producing there minute black spots, and thus interfering with the results of this test.

I have found that exceedingly minute quantities of arsenic can be readily detected by this very simple process : thus the 1-1000th part of a grain of arsenious acid, dissolved in 1 c.c. of distilled water, gives a very decided effect in a few moments; but much smaller quantities are detectable by it: thus the 1-100,000th or even the 1-1,000,000th part of a grain of arsenious acid, dissolved in the same quantity of water (1 c.c.), will afford, by the blackening of the silver salt, after a little time, an indication of the presence of arsenic. I have also ascertained that this method of detecting arsenic is not only directly applicable to where it exists as arsenious acid, but likewise to several other compounds of arsenic, whether they are soluble or insoluble in water: thus, for example, the two sulphides of arsenic (orpiment and realgar), the alkaline arseniates, and even metallic arsenic itself if reduced to powder, will readily show their arsenical nature by this test; and we may in a few moments detect by it the occurrence of arsenic in different green, yellow, and orange pigments, which are still much employed in the manufacture of wall-papers, in painting, and in the colouring of certain textile and other articles used in dress or for ornamentation. Thus, for example, if a little of the colouring matter of any arsenical pigment be scraped off from a wall-paper, or a small piece of the paper itself be taken and placed in a test-glass with a little water, and having been stirred or shaken to detach the colour, a piece of the amalgam be added, it will—by the blackening of the silver salt employed as before described—soon indicate the presence of arsenic. In the same way it can be easily demonstrated that the colouring matter in certain green tarletans, calicoes, and other articles used for dress or for ornament, are arsenical. I may further state that the presence of organic matter seems to interfere but little with this test, for I have found that very minute quantities of arsenious acid, when mixed with considerable amounts of milk, tea, coffee, ale, porter, soup, or stirabout, could—with almost the same facility—be detected by this method, as where they were only simply dissolved in water; thus showing that the cases to which it is applicable are very extended.

But I should here observe that, as in the case of Marsh's original method, there is one other metal which under certain circumstances, will produce with the sodium amalgam results closely resembling those occasioned by arsenic : the metal I refer to is antimony, which is capable of uniting with nascent hydrogen to form a gas (antimoniuretted hydrogen), which, coming in contact with nitrate of silver, produces a black antimonide of that metal, by the following reaction :—

$$H_3Sb + 3AgNO_3 = Ag_3Sb + 3HNO_3,$$

and the blackening of the silver salt from the formation of that compound might be easily mistaken for the effect produced by the arsenical gas.

But owing to the fact, first pointed out by Fleitmann, that antimoniuretted hydrogen is not evolved (except, perhaps, as a mere trace) from strongly alkaline solutions, though the conditions may exist there for its formation, and as the action of the sodium amalgam is to render the mixture quickly alkaline, there will be only a very minute quantity of the antimony that may be present so evolved; and, by previously rendering the mixture strongly alkaline, we may almost altogether prevent the evolution of that gas. If, however, we make the mixture containing the antimony in solution first strongly acid, and then add the amalgam, or even acidify after its addition, the antimoniuretted hydrogen will be evolved in abundance, producing a deep black stain on the paper moistened with the nitrate of silver; and, for the purpose of this acidification, I have found that tartaric acid answers very well. As the presence of alkalies in solution do not interfere with the evolution of the arsenical gas, this is itself a means of distinguishing the two metals, arsenic and antimony.

But it may be occasionally necessary to determine whether the effects observed on the paper moistened with nitrate of silver are due to arsenic or to antimony. There are different methods by which we may determine this question; but the one I have found the simplest, and on the whole the most satisfactory, is to digest the paper stain in sulphide of ammonium, when the arsenic or antimony present will be converted into a sulphide, and dissolved by the excess of the alkaline salt, leaving the silver sulphide undissolved, and adhering principally to the paper; the alkaline solution, on being evaporated to dryness, will, in the case of arsenic, leave a bright yellow residue almost insoluble in hydrochloric acid, whereas in the case of antimony an orange one will remain, which readily dissolves in that acid, at least on the application of heat.

Before concluding I wish to observe that, according to some experiments recently made by Dr. Russell, it appears that hydrogen alone is capable of reducing solutions of nitrate of silver to the metallic state; but this action, even from his observations, is an exceedingly slow one, and takes place to a very minute extent in dilute solutions. On the other hand, M. H. Pellet maintains that hydrogen carefully freed from acid and arsenic, by passing it through solutions of soda and of nitrate of silver, has no action on that salt at the ordinary temperature. But he states that nitrate of silver which has been fused possesses an alkaline reaction in solution, and that a slight precipitate is produced in such by pure hydrogen : if, however, he observes, a drop or two of nitric acid be added, then nothing is precipitated. Be this as it may, as regards the reducing action of pure hydrogen, I found, in an experiment I made, that hydrogen which had been passed through solutions of caustic soda, and of nitrate of silver, and was afterwards brought in contact with a porcelain crucible cover, moistened with the dilute and acidulated solution of nitrate of silver already noticed, produced only the faintest possible effect, even after several hours' exposure to a stream of this gas, and this very slight action might possibly be due to the hydrogen not being perfectly freed from its impurities. Consequently, it is very doubtful that any reduction of the silver salt from the hydrogen alone will occur under the circumstanes of the proposed test. Finally, I must observe that where paper moistened with the silver solution is used to detect

arsenic or antimony, we must bear in mind that nitrate of silver will alone, after some time, blacken the paper, especially if it is exposed to the light; but this gradual change which is so produced is very unlike the rapid effect that takes place where either arseniuretted or antimoniuretted hydrogen acts on paper moistened with that silver salt.

ACTION OF AMMONIA UPON ROSANILINE.

By M. E. JACQUEMIN.

MM. Persoz, De Luynes, and Salvétat* have shown that magenta, since named rosaniline, is capable of playing the part of a feeble acid; that it combines with ammonia to form a compound, colourless, but alterable even by an excess of the solvent, and incapable of dyeing without the intervention of an acid which displaces it and restores to it the power of combining with the fixtile fibre.

In 1861, resuming the study of this question after the publication of my memoir on the aniline-reds,† I remarked that the alteration of magenta is not immediate; that it is only produced gradually; and that a certain number of days are required for it to become complete. I have shown every year since that time in the Course of Organic Chemistry at the Higher School of Pharmacy, at Strasbourg, that it is possible to render manifest the presence of the colour up to its entire transformation. It is simply requisite to steep wool, previous moistened, in the colourless ammoniacal solution, which is heated moderately, but not to the boiling-point. The curious phenomenon is then produced of a tissue which is dyed a bright red in a colourless liquid. According to Dr. Hoffman aniline-red is a compound of a colourless base and of an acid. But this acid in the commercial substance, having entered into combination with ammonia, it is not possible to admit that the wool induces the decomposition of the ammoniacal salt and the reconstitution of the red in order to combine with the latter. We are led to consider the combination of the rosaniline and the ammonia as a molecular compound which is dissociated by heat, the wool having the property of uniting with the colourless base, which abandons the ammonia, and of filling as regards it the function of an acid in producing a red compound.

Having continued the study of this question, I shall have, in my next communication, the honour of pointing out the products of the decomposing action exercised by ammonia on the different aniline colours, and of defining more precisely its first function. It will then be seen that it is not even possible to admit always a molecular combination, and that, in the case of aniline-blue for instance, it is not necessary to go beyond the phenomenon of simple solution, since a skein of cotton steeped in the liquid is dyed blue by the simple process of the evaporation of the solvent in the air.—*Comptes Rendus.*

Mineralogical Society.—At the meeting held on Thursday, the 3rd inst., the following Officers were elected, viz.:—

President—H. C. Sorby, F.R.S.

Vice-Presidents—Prof. Haughton, F.R.S.; Prof. Heddle, P.R.S.E.

Council—Prof. Ansted, F.R.S.; Prof. Bonney, M.A.; Prof. Church, M.A.; W. Crookes, F.R.S.; F. Drew, F.G.S.; Major Duncan, D.C.L.; A. Geikie, F.R.S.; Capt. Marshall Hall, F.G.S.; Prof. T. Rupert Jones, F.R.S.; Prof. Nicol, F.R.S.E.; Prof. Rudler, F.G.S.; R. H. Scott, F.R.S.

Treasurer—R. P. Greg, F.G.S.

Foreign Secretary—C. Le Neve Foster, D.Sc.

Secretary—J. H. Collins, F.G.S.

* "Rapport d'expertise sur le rouge d'aniline," 1860; Pelouze et Frémy, *Traité de Chimie*, 3rd edition, t. iv., p. 710.

† February, 1861, "Proces Renard et Franck contre Depouilly freres et Ch. Lauth."

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, February 3rd, 1876.

Professor Abel, F.R.S., President, in the Chair.

The minutes of the previous meeting having been read and confirmed, the presents of books made to the Society were announced, and the donors thanked; after which Messrs. A. Smetham, B. Shirley Dyer, W. E. Halse, and E. H. Girling were formerly admitted Fellows of the Society. The names read for the first time were those of Messrs. A. B. Prescott, M.D., N. Bradley, and S. W. Porter. Messrs. William Galbraith, David E. Brown, A. H. Scott White, B.A., George Wilson, M.A., William Foulkes Lowe, Stephen William Nockolds, George Haycraft, Frederick James Lloyd, Harry Allen, Frederick Isenbart Scard, Harold Bailey Dixon, and William Alexander Smith were elected Fellows after their names had been read for the third time.

The President said he had to announce that he had obtained permission to invite the Fellows of the Society to visit the Royal Arsenal at Woolwich, and hoped that on that occasion he should be able not only to show them a trial of the 80-ton gun and the working of the largest forge-hammers, but also to exhibit some experiments on detonation which could not be conveniently performed in the lecture-room, and other kindred subjects which might prove of interest to the Fellows.

Mr. W. Ackroyd then read a communication on "*Metachromism, or Colour Change.*" In this elaborate paper the author, after giving a brief account of the notices scattered throughout various scientific papers on the subject of metachromism, as he terms the changes of colour which various substances undergo when heated, passed on to the classification of metachromes, which he arranges in two groups,—namely, those of the zinc oxide class, colourless bodies which acquire a yellow colour on being heated; and those of the borate of copper class, which change from one colour or combination of colours of the spectram to the contiguous colours: the red iodide of mercury, for instance, becomes darker and darker, as it is heated, up to about 140° C., when it is converted into the yellow modification. At higher temperatures the yellow becomes gradually darker, until at 220° C. it is deep orange. From a study of the two classes the following metachromatic scale was arrived at:—

White, colourless, violet, indigo, blue (metallic appearance), green, yellow, orange, red, brown, black.

The colours of the more refrangible end may be replaced by a metallic appearance. Metachromism has an important bearing on allotropy. A body expanding through the influence of heat being really a continuous series of allotropes. In support of this the relation of colour and density was discussed. It was shown that metachromism is due to the storage of potential energy, the author holding that molecular vibrations or kinetic energy have nothing to do with this phenomenon of selective absorption. Contracting metachromes changing from less to more refrangible colours, where would this change cease providing a low enough temperature could be had? Presumably at the absolute zero of temperature and at this point all metachromes would be white or metallic looking, judging from their behaviour at attainable temperatures. Following expanding metachromes *from the absolute zero of colour* the change in each would vary with the coefficient of expansion, giving us at the normal temperature all that variety of hue which we see in the inorganic world. Including certain cases of decomposition (given in a table), colour change may denote—

(1). If to more refrangible—*a* contraction, or
β decomposition.
(2). If to less refrangible—*a* expansion, or
β combination.

The observations relate to anhydrous and for the most part binary compounds.

The paper concludes with some remarks on the simultaneous change of colour and density observed on heating certain minerals, such as zircon.

The PRESIDENT said they were much indebted to Mr. Ackroyd for his interesting paper, which raised several points for discussion.

Mr. W. N. HARTLEY said for the past two years he had made many experiments on the changes which solutions of certain salts undergo when heated, but in most cases the change was due to a variation in the hydration of the salt, the series of colours produced, however, being somewhat in the order given by the author. For instance, the brown or pink solution of cobalt, when heated, darkens at first, the effect being probably due to expansion, but variation in the hydration then begins to come in, and the brown hexahydrate is reduced to the green dihydrate. Again, the yellowish green colour of a solution of copper chloride turns to brown when heated to 100° C., which may perhaps be due to metachromism. The solid copper bromide behaved in an entirely different manner; the golden yellow tetrahydrate loses water at a comparatively low temperature, changing to the brown monohydrate. The yellowish green solution of the salt changes to brown when heated like the chloride. In those solutions, however, in which no change of hydration takes place, the solution darkens, which is in accordance with Mr. Ackroyd's observations. A peculiar phenomenon is observed when dichroic minerals such as epidote are heated; the dichroism entirely disappearing under these circumstances.

Mr. FRISWELL understood the author to say that if the colour changed to one at the more refrangible end of the spectrum, decomposition usually took place. He would like to ask whether he had examined any of the platinocyanides: the red hydrated magnesium salt, as was well known, when heated, lost water, and changed first to orange, then to yellow, and finally to white, whilst the barium compound under similar circumstances also lost water, but changed from brilliant yellow to red-brown. Both these compounds undergo decomposition, and yet a change took place in opposite directions in the two cases.

Mr. JOHN A. R. NEWLANDS said that metachromism pure and simple included such changes as that of a white substances which when heated became yellow and on cooling regained its original colour. Other changes of a more permanent kind, as that of the scarlet mercuric iodide into the yellow modification of the same substance, having a distinct crystalline form, could hardly be included under metachromism, but might be rather considered as due to some chemical change. If the yellow mercuric iodide be regarded as the simple molecule, the scarlet modification might possibly be a combination of mercuric iodide with itself. At any rate it would be well to keep in view the possibility of the chemical combination of two or more molecules of the same substance producing effects akin to those originating in metachromism.

Mr. ACKROYD replied, that in the case of mercuric iodide he had determined the specific gravity before and after the change, but the results were not concordant: the change from red to yellow would indicate contraction however. He had not examined the platino-cyanides.

Mr. HARTLEY said he might mention he had once observed that a magnificent specimen of the magnesium platino-cyanide, sealed up in a specimen glass which had been placed for a short time near a gas flame, lost its beautiful green iridescence, and became of a yellowish colour: after remaining some time in a cool place, it re-absorbed the water which had been expelled, and regained its original appearance.

Mr. W. H. PERKIN, F.R.S., then read a paper "*On the Formation of Anthrapurpurin.*" Although it was known that potassium anthraquinon-monosulphate, when fused with caustic potash, yielded alizarin, it was generally believed that in the artificial preparation of alizarin the latter was produced from the disulphonic acid. This the author finds, however, is not the case: the alizarin is produced from the monosulphonic acid, whilst the disulphonic acid yields anthrapurpurin, a substance in many of its properties akin to alizarin. When the disulphonic acid is heated with potassic hydrate, it first yields oxyanthraquinon-monosulphonic acid, $C_{14}H_6O_4(OH)(SO_3H)$, and this, by the further action of the fused alkali, is changed to anthrapurpurin, $C_{14}H_6O_2(OH)_3$. The action of an aqueous solution of potash at a high temperature on this acid gives rise to an intermediate body, $C_{14}H_6O_2(OH)_2$, isomeric with alizarin, and apparently identical with the substance recently observed by Schunck and Roemer. It is converted into anthrapurpurin by the further action of the alkali. In alizarin the hydroxyls are both in the same benzene group, but in anthraquinon-disulphonic acid it would appear that one HSO_3 exists in each benzene group, which would account for the non-formation of alizarin from this acid when it is heated with an alkali, and would, moreover, tend to show that in anthrapurpurin two hydroxyls are in one benzene group and one in the other.

Dr. ARMSTRONG remarked there could be no doubt that anthraquinon had the formula—

$$C_6H_4\begin{matrix}CO\\CO\end{matrix}C_6H_4,$$

and since alizarin yielded phthalic acid on oxidation it was highly probable that the two OH groups were both in one benzene group, a view which was confirmed by the synthesis of alizarin from phthalic acid and pyrocatechin. The discovery of an isomeride of alizarin, to which the author had alluded, was of great interest: there were now five bodies known having the same composition as alizarin.

Mr. PERKIN said the isomeride alluded to did not yield phthalic acid on oxidation, from which it was probable that both the OH groups were not in the same benzene group. Anthraflavon, also, did not yield phthalic acid.

The PRESIDENT having thanked the author in the name of the Society, a communication from Mr. C. O. SULLIVAN "*On Maltose*" was read, in which the author conclusively proves that maltose obtained by the action of malt extract on starch is not merely a mixture of dextrose and dextrin, but a distinct compound. Comparative experiments were made by treating both a mixture of dextrose and dextrin with alcohol, and also maltose. In the former case the dextrose was removed, leaving a residue of dextrin which had scarcely any action on Fehling's test. With maltose, however, the case was different, the portion which dissolved having exactly the same reducing action as the undissolved portion. Fermentation experiments made with maltose and the above mixture led to analogous results. He concludes with observing that maltose is a distinct compound, isomeric with cane-sugar, and having a specific rotary power rather more than twice as great; moreover, 100 parts of maltose are capable of reducing as much cupric oxide as 65 parts of dextrose.

The PRESIDENT thanked the author, in the name of the Society, for his interesting communication; after which a paper by Mr. T. FLETCHER was read, on "*A Simple Form of Gas Regulator*," in which the author states he has had a regulator in use for the last fifteen years very similar to that recently described by Mr. Page, except that he passes the gas in the reverse way, and considers it is practically better to have a pin-hole in the cork or centre tube, to prevent the gas being extinguished, instead of the double service. He also recommends an iron chamber of large size, containing 2 or 3 lbs. of mercury.

The last paper, by Mr. T. CARNELLY, B.Sc., "*On High Melting-Points, with Special Reference to those of Metallic Salts*," was taken as read, owing to the lateness of the hour. The principle upon which the experiments described

in this paper were conducted consists in heating a small platinum crucible containing the salt by means of a Bunsen, or other suitable means, and the instant the salt is seen to melt the whole is dropped into cold water. From the observed rise of temperature the melting-point of the salt can be calculated. Tables are appended to the paper giving the fusing-points of a large number of substances as observed by this method.

The meeting was finally adjourned until Thursday, February 17th, when Prof. Frankland, F.R.S., will deliver a lecture "On some Points in connection with the Analysis of Waters."

NOTICES OF BOOKS.

On the First Principles of Chemistry. By EDMUND J. MILLS, D.Sc., F.R.S., Young Professor of Technical Chemistry in the Andersonian College, Glasgow. (Reprinted from the *Philosophical Magazine* for January, 1876.)

DR. E. J. MILLS—but lately elected Young Professor of Technical Chemistry in the Andersonian College, Glasgow—has published an essay on the first principles of chemistry. Issuing, as this does, from a Chair of Chemistry at one of our Universities so justly famed for its advancement of natural science, we of course look for something the perusal of which shall reward us.

In treating of a matter which more than borders on the region of metaphysics, it is only natural that a writer should indulge in preliminary considerations of a so-called philosophical character before attacking the actual subject which he intends to discuss. Dr. Mills forms no exception to this rule, but rather avails himself of the privilege to its fullest extent. Let us, however, first listen, and afterwards judge.

Our author, then, commencing with some highly laudatory observations upon Ferrier and his philosophy, after quoting several most amusing passages from the eccentric author of "Les Institutes," and after subsequently pointing out to us what he considers to be the analogy between the final triumph of human reason and the lesson inculcated in the parable of the Prodigal Son, proceeds to the consideration of the difficulties of investigating first principles in language replete with metaphor, the quotation of which in its entirety space alone precludes.

But one of the passages in this paragraph demands special attention. Speaking of the ideal reformer who would "disinter the pure jewels of science" lying deep under a metaphorical roadway, Dr. Mills says:—

"He must have an infinite capability of doubting. For his is no search for truth—of which all men chatter, but which none are admitted to possess; his is a reasoned labour, and the issue, of which he is careless, must in the main be wise."

Calm contemplation of these sentences is unavailing. They may be "chewed," but are not to be "digested." Absence of conspicuity of expression in the handling of such themes as the present one is no rare thing; but Kant, at his worst, leaves us a loophole of meaning, and even Schopenhauer does not desert us in the dark. Macaulay said somewhere that there are arguments, the mere statement of which constitutes their refutation; but Dr. Mills in here avoiding that lucidity so characteristic of such stylists as Prof. Huxley or Dr. Tyndall, may be said to have afforded us arguments of a most irrefutable character.

Is the search for first principles no search for truth? Are men to be careless of the issue of their research? It is as difficult to reply to these questions as it is to the one Dr. Mills asks his readers immediately after the passage above cited. To quote—

"*Such being the case*, can we wonder that no clear statement of the first principles of chemistry has ever yet been made, and that even the very definition of the science is either unknown or obscure?"

Dr. Mills becomes more intelligible further on where he advocates reform—a reform which means nothing more nor less than the disestablishment of an ancient institution, the atomic theory. In asking "Where then are we to commence?" Dr. Mills says:—

"The first principle of all science is motion. Every event of which we are conscious proves on analysis to be motion of some kind, and matter is not distinguishable from motion except as more or less determinate motion."

Matter and motion are very inseparable ideas in many, and in fact most minds, but it is surely going rather far to speak of one as "not distinguishable" from the other.

"We have then to select those derived forms of motion," Dr. Mills goes on to say, "which, lying nearest to it, are yet within the province of chemistry. One of these must necessarily be action, because the chief business of chemistry is a kind of work." And, moreover, a hard kind of badly-remunerated work. Further on we read:—

"Chemical substances are valued, not for what they are conceived as *being* but as *doing*, and the first question we ask about a body is—What is its function?"

Very true. But Dr. Mills, it would seem, fails to distinguish nicely between "property" and "function," for the first questions he asks about a body are—Has it an alcoholic function? or a saline function? or a ketonic function? or a zincous function? or a chlorous function? questions which he answers through the agency of what he is pleased to term "elementic discriminants." Later on in his essay Dr. Mills contents himself with remarking that "constitution" has been, and always is, considered of small importance in comparison with "action." The two standing to one another, as he somewhat synonymously expresses himself, "in the relation of speculation to experiment."

"Indigo, sugar, salt, and alcohol," says Dr. Mills in pursuing this idea, "were extremely valuable before anything whatever was asserted of their constitution—valuable then as now for the employments to which they could be put." "The producer," he continues, "prudently regarding their constitution with a wise indifference." Some would have called the producer *imprudent* and his indifference *unwise*, but this is of course merely a matter of opinion.

After reaching this climax, Dr. Mills descends from his flight of diction, and becomes once more interesting and intelligible. The following two passages give us the text, as it were, of our sermon:—"The most important character of chemical action is continuity, which, as has already been stated, is an immediate derivative of the idea of motion." And somewhat later—"For it is as experimentally certain that the generated substances take part in a reaction as it is that the generators themselves share therein. When, therefore, a body is enclosed in some vessel, and set aside, it must not be regarded as inactive; it may quiver, but will not expire."

By which Dr. Mills would say that chemical action never ceases. He would assert, and practically does (in the last quoted passage) assert that when, for instance, a mixture of oxygen and hydrogen, containing these gases in the theoretical proportion necessary for the formation of water, is exploded, some further chemical action continues, and water acts upon water. But of what nature is this continued action, and upon what observations does Dr. Mills base his assumption?

So much for continuity of chemical action, to which we return immediately. Let us hear what Dr. Mills says as regards chemical mass:—

"According to the evidence we possess (and some of it is of the highest order of accuracy), no matter what may be the masses of the substances acting, the entire mass of each takes part in the process."

The expression "takes part" is as vague as many of Dr. Mills's pet expressions. There can be no doubt as to

the influence which mass exerts upon chemical action, but whether that influence is entirely physical or entirely chemical, or partly both, are questions which still await reply. Now Dr. Mills asserts that if, for instance, an ounce of zinc be immersed in water, and a quantity of sulphuric acid added, the whole of this reagent acts whether it weigh an ounce, or a pound, or a hundredweight, and that all the excess of acid which is not required to make zinc sulphate should not as "undeniably sharing in the process" be omitted from the equation symbolising that process. It must be admitted that practically (and we use this term advisedly) an excess of acid appears necessary for the complete solution of *all* the zinc present, but this excess can never be admitted as theoretically necessary, for were this so we should indeed have to abandon our atomic theory. The most plausible argument that atones for this apparent deficiency in theory is that the excess of acid replaces one of the factors necessary for the theoretical realisation of the process, and that the replaced is that most convenient of all factors —*time*. Looked at from this point of view, such an equation as $Zn+H_2SO_4=ZnSO_4+H_2$ ceases, we think, to deserve being spoken of as expressing but a "poor and single point" of the process.

Dr. Mills next proceeds to discuss the well known researches of Harcourt and Esson, and those of Guldberg and Waage, on the influence of mass, time, &c., on chemical action. The former chemists assert to have shown that in chemical action the amount of change is at each moment proportional to the total amount of changing substance, but they do not, at the same time, dispute the truth of Dalton's "definite proportions," and certainly do not disprove them. Guldberg and Waago, arriving at the same results, argue further that the researches of Berthelot, Scheerer, and more particularly those of Debus, in the other direction, give results capable of representation on their principles. But Bunsen's experiments on the explosion of mixtures of certain gases would seem to point to conclusions of a very opposite tendency, and results might, in fact, be thus stated :—In that mutual decomposition of bodies called chemical action all quantities present do not act, but only (and generally a small) proportion of the whole, and that in the case of bodies in solution the proportion between the acting masses and the total mass would mostly appear to be always continuous; but that in the case of gases (Bunsen) this proportion, though always admitting of representation by simple ratios, is not continuous but discontinuous.

Now Dr. Mills argues that Bunsen's experiments go to prove continuity in place of that discontinuity to which they apparently point; but the only argument he brings against them is that one has no right to deduce discontinuity where it has been expressly introduced. It might, however, with equal justice, be said that we have no right to deduce continuity where the unavoidable conditions of experiment would specially favour it; so that in saying that those positions in chemical action which Dalton termed "definite proportions" are fitly conceived as *maxima* and *minima* on curved lines Dr. Mills is giving us a very fascinating idea, which, however, requires the further corroboration of facts ere it can be fully accepted as the explanation of facts.

And now Dr. Mills deserts chemistry to launch us in the midst of metaphysics. He raises, but does not solve, the question whether matter, considered as directed concrete isolable motion, may not be transferred into energy that is diffuse, or non-isolable motion, or *vice versa*. As a small result of which consideration we are told that water cannot consist of oxygen and hydrogen, and that no one can assert that argentic chloride has the same composition now as it had (in the good old times) one hundred years ago! But this is not all. As a further and far more important result of such cogitations Dr. Mills would abolish the vulgar chemical equation, ignore the theory of "constitution," and dispense with the Berzelian nomenclature; and having thus left us, as it were, without a chemical leg to stand upon, he comforts us with the assurance that chemistry existed before Dalton.

Dr. Mills's suggestion of replacing the old chemical symbols by mathematical ones as expressing continuity is very worthy of attention, but, as many of Dr. Mills's suggestions are, is far in advance of facts. The same remark applies to Dr. Mills's idea with regard to a dynamic equivalent, or Bergmannic as he christens it. "It is sufficiently obvious," he says, "that the real equivalent of a body is that which performs the unit of work, however that unit may come to be defined."

For example, if i stand for baric iodide, and c for baric chloride, we have a solution of the equation—

$$i=fc.$$

This indicates a field of research, and is certainly the best thing in the essay.

As regards Dr. Mills's "energy" explanation of isomerism, and also as regards his researches on "valencies," we must refrain from more than mentioning these, and refer the reader to the tabular summary of the principles advocated by Dr. Mills at the end of his essay.

And now having followed Dr. Mills somewhat closely in his arguments, one may well ask with him :—

"What is the practical result of this discussion?"

Dr. Mills challenges the reader to choose between the "atomic" theory and the so-called "dynamic theory," and some readers might give him this answer :—

What is theory after all but the logical interpretation of accepted facts which, becoming the basis of new generalisations, induces the discovery of new facts. But facts must precede theory. And the atomic theory is, we assert, in its widest development a logically admissible interpretation of those facts which are already known to us, but Dr. Mills would have us put this aside and advocate a theory for which facts, as he himself admits, have as yet specially to be created—a theory which is therefore, as Dr. Mills states it, no theory at all in the stricter sense of the word but a system of metaphysics. Such a system as approaches nearest to those of Schelling and Hegel, but which in its main principle is far older than the science of chemistry itself.

To adopt somewhat the phraseology of Dr. Mills the reader might continue to say that rather than desert the strict path of inductive inference to wander in the fascinating but delusive mazes of metaphysics, he (the reader) would prefer to retain the "atomic" theory because accumulating facts warrant its retention rather than its rejection, and because, as Dr. Mills himself says, in a mood which none can too much admire, "It is juster and wiser to accept facts than to attempt to transcend them."

H. W. H.

CORRESPONDENCE.

SPRENGEL'S WATER-VACUUM PUMP.

To the Editor of the Chemical News.

SIR,—Circumstances have, till now, prevented my calling attention to an error committed by one of your contributors in your final issue for 1875. Mr. W. Thomsom, F.C.S., speakes (CHEMICAL NEWS, vol. xxxii., p. 310) of "Bunsen's vacuum pump."

Now those people who persist in speaking of the "water pump" as Bunsen's may think they have sufficient warrant for doing so, although (as I shall presently show) they have not a particle. But this Fellow of the Chemical Society, without referring to the fluid used for obtaining the vacuum, or, indeed, without mentioning Bunsen's appliances for using the vacuum, speaks of the method of obtaining a vacuum discovered by Sprengel as though it were due to Bunsen. Doubtless he sins in

company with a great many others, but the persistent ignoring of the facts thus displayed ought, in common fairness, to be put an end to.

Bunsen has said (*Phil. Mag.*, [4], vol. xlv., p. 153):—"The interesting discovery that by means of columns of liquids flowing downwards a more perfect vacuum can be produced than was possible by the air-pumps hitherto in use, belongs solely and only to Dr. Sprengel." He, in his "Researches on the Vacuum" (*Journ. Chem. Soc.* 1865) brings prominently forward that water is, from a practical point of view, the only liquid which could come into consideration as a substitute for mercury, used in the instrument described by him. Bunsen adds, further on, —"If, in the face of these facts, which are open to all, anyone attributes to me . . . a share in his [Dr. Sprengel's] discovery, I can regret this only all the more keenly, as in my treatise on the new method of filtration I could not possibly have expressed myself with regard to Dr. Sprengel's claims more loyally and precisely than I have done."

Bunsen's fame does not require to be supported by injustice towards a fellow-worker to whom we are all so much indebted. Let me advise Mr. W. Thomson and others to read carefully Sprengel's paper, and, in future, when the "water-pump" or "vacuum-pump," which is used with Bunsen's filter, is spoken of, let it, instead of being linked with the name of anyone who may happen to apply it to a particular purpose, be associated with the name of the true discoverer, Sprengel,—I am, &c.,

F.C.S.

NOTES ON AQUEOUS ALCOHOLS.

To the Editor of the Chemical News.

Sir,—In reference to a remark which appears in the report of Messrs. Dittmar and Stewart's "Notes on Aqueous Alcohols," allow me to state that Dupré's alcohol was not largely contaminated by aceton. The methylic alcohol employed had been most carefully prepared, and 20 grms. of it, when oxidised with sulphuric acid and potassium dichromate, yielded only traces of acetic acid.

A. Dupré.

Laboratory, Westminster Hospital,
London, February 7, 1876.

ON THE NECESSITY FOR ORGANISATION AMONGST CHEMISTS.

To the Editor of the Chemical News.

Sir,—I read with deep interest the article by C. R. Alder Wright, D.Sc., in the Chemical News, vol. xxxiii., p. 27, and hope to find that the proposal it contains to obtain a charter to constitute a Guild of Analysts and Assayers will meet with an immediate and hearty response by all who follow those professions. It is a fact—however much the necessity is to be deplored—that some such means of both excluding and extruding incompetent persons from the practice of commercial analysis cannot be much longer delayed if conscientious and experienced men are to win a living and save themselves from the aggravation of having their carefully executed assays placed side by side with the results of the rough and ready, not to say slipshod, work of every novice. Dr. Wright very ably advocates the necessity for organisation amongst professional chemists, and his paper deserves their serious reflection. I trust other qualified gentlemen will kindly come forward and assist him to put the proposed association into operation.—I am, &c.

Maitre Essayer.

Sheffield.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences. No. 3, January 17, 1876.

Action of Fuming Sulphuric Acid upon the Carbides of Hydrogen.—M. Berthelot.—The author remarks that the action of sulphuric acid upon organic compounds gives rise to five principal phenomena; that is to say, combination of the acid with the organic matter; dehydration, or consecutively hydration of the organic matter; its polymeric condensation; and, finally, its profound destruction, with liberation of sulphurous acid. Without stopping to consider the last result, which is generally complicated with the four others, he examines the evolution of heat corresponding to the former.

Transformations of Cane-Sugar in Crude Sugars and in the Sugar-Cane.—M. A. Müntz.—The sugar possessed of reducing properties existing in crude sugars and in the cane ordinarily consists of an inactive glucose, with which are often associated variable proportions of normal glucose and of levulose.

Optical Inactivity of the Reducing Sugar Found in Commercial Products.—MM. Aimé Girard and Laborde.—The authors consider it established that there exists in commercial products a reducing sugar having no sensible influence upon polarised light, and consequently incapable of influencing the results furnished by the polarimeter.

Spectrum of Nitrogen, and on those of the Alkaline Metals in Geissler's Tubes.—M. G. Salet.—The author, with reference to the researches of Schuster, published in 1872, proposes to demonstrate that a grooved or fluted spectrum can be produced with nitrogen heated in contact with sodium; that the disappearance of the spectrum of nitrogen is due to the disappearance of the nitrogen itself, which is totally absorbed by sodium under the influence of the electric effluve; and that the spectrum described by Schuster should probably be ascribed to the vapours of the alkaline metal.

Certain New Derivatives of Anethol.—M. F. Landolph.—The author examines the reaction of alcoholic potassa upon the hydride of anethol; of perchloride of phosphorus upon anethol; of alcoholic potassa upon monochlorinised anethol; and of acetic ether upon diphenol.

Synthesis of Aniline-Black.—M. J. J. Coquillion.—To demonstrate that aniline-black may be obtained without the intervention of a metal the author had recourse to the following precautions:—The slips of carbon which served as electrodes were exposed for three hours to a current of chlorine in a porcelain tube heated to redness. They were then boiled in nitric acid, again submitted to the action of chlorine, and washed in distilled water, when they might be regarded as pure. These points were 1 decimetre in length. To effect the electrolysis two platinum wires were coiled round their upper parts, and were connected with the two Bunsen elements made use of in these experiments. As soon as the lower extremities of the carbon points were plunged in the salt of aniline the positive electrode became covered with black, whilst hydrogen escaped from the negative pole. It seems, therefore, beyond doubt that aniline-black may be produced without the action of any metal. This fact being established, it remains to be seen which salts of aniline are capable of yielding aniline-black. The hydrochlorate and the sulphate alone seem able to produce the black under practical conditions. The author has previously shown that these two salts, when submitted to electrolysis, yield, after the lapse of twenty-four hours, a paste-like mass surrounding the positive electrode. This mass, when

washed and dried, is soluble in concentrated sulphuric acid. It has a blackish violet tint, analogous to a solution of violaniline in the same acid; but if water be added to the dissolved black a greenish mass is immediately precipitated—a phenomenon which does not occur in case of violaniline. This is an important character which seems to distinguish aniline-black. This reaction may be obtained even with a slip of dyed cotton. The greenish flakes, however, resume their original black colour if the acid is neutralised with ammonia or potash. Two other salts of aniline, the arseniate and the phosphate, or rather a mixture of phosphates, likewise yield aniline-black. With two Bunsen elements, however, the operation is slow and difficult. The solution of these salts is syrupy, and after the lapse of twelve hours there are obtained merely small quantities of a black, which likewise is soluble in concentrated sulphuric acid with a red-violet colour, and on adding water deposits greenish flakes. The colours, however, do not appear to be identical with those obtained from the hydrochlorate and the sulphate. These salts are not likely to be used in practice. The black from the nitrate of aniline, and that from the acetate, do not present this reaction, and their molecular constitution is probably different. Thus, from a theoretical point of view, we see that it is possible to form aniline-black by direct synthesis, and that the same method may doubtless realise analogous synthesis. From a practical point of view, the results are also not without importance. For the success of the operation the solutions ought to be concentrated. Practical men should therefore add as little water as possible, and keep within the limits which experience will easily indicate. The other laws of electrolysis have also their application. Every cause which tends to separate the molecules assists the reaction; a more elevated temperature will therefore be favourable, but to ensure uniformity of shade the temperature must be uniform also. A diminution of pressure will have an analogous effect. The printer must therefore beware of employing, as was formerly done, cast-iron drums, where the gases from the reaction, finding no escape, augment the pressure, and thus hinder the formation of the black.

Bulletin de la Societe Chimique de Paris, No. 12, December 20, 1875.

Spontaneous Coagulation of Blood: Gases of the Blood Before and After the Production of the Fibrin.—M. A. Gautier.—A reply to the last paper of MM. Mathieu and Urbain.

Combination of Phenol with Sulphate of Quinine.—M. S. Cotton.—This compound is remarkable for its stability, and possesses a considerable antiseptic power.

Preparation of Acetate of Ammonia and Acetamide.—M. J. A. Roorda Smit.—Crystallisable acetic acid is placed in a flask and heated in the water-bath, small fragments of carbonate of ammonia being added to saturation. In preparing acetamide the products distilled below 200°, which are always acid, are to be heated and neutralised with carbonate of ammonia.

Reaction of Sulphite of Ammonia and Nitrobenzine.—J. A. Roorda Smit.—The products obtained are sulphanilate and disulphanilate of ammonia.

Correspondence from St. Petersburg of Nov. 21st (Session of the Russian Chemical Society, Oct. 2/14, 1875).—W. Longuinine.

M. Lioubavine gave an account of the changes undergone by aldehyd-ammonia exposed to the air, and of the action of trimethyl-aniline upon aldehyd.

MM. Beilstein and Kourbatoff announced that in the reaction of perchloride of antimony upon nitro-benzine in presence of ether, metachloro-nitro-benzine is produced.

M. Borodine made a communication on the nitrosoamarine obtained by the action of nitrite of potassium upon a solution of amarine in presence of acetic acid.

M. Schmit, on behalf of M. Orlowski, gave an account of experiments undertaken to obtain the tricarbonated acid intermediate between the methyl-tricarbonic and the carballylic acids.

The *Transactions* of the Society further contain a paper on the order in which the addition and separation of the elements of hydriodic acid take place, by M. A. Zaytzeff. There is also a memoir by MM. Wagner and Zaytzeff, on the "Bromide of Amylene and the Amylenic Glycol of Diethyl Carbinol." Lastly, there is a paper by the same authors on the "Transformation of Diethyl-Carbinol into Methyl-propyl Carbinol," connected with previous researches of Messrs. Erlenmeyer and Wanklyn.

No. 1, January 5, 1876.

Saccharification of Amylaceous Matters.—M. L. Bondonneau.—Already noticed.

On Active Malic Acid.—G. J. W. Bremer.—Malic acid derived from dextro-tartaric acid causes the polarisation plane of light to deviate to the right, its rotatory power being $+3^{\circ}157^{\circ}$. Malic acid from the mountain ash has the rotatory power $-3^{\circ}299^{\circ}$.

On a Secondary Hexylic Alcohol.—W. Œchsner de Koninck.—Already noticed.

Sulphocyanates of Acid Radicals.—P. Miquel.—The author has prepared the sulphocyanate of benzoyl, C_8H_5ONS, a colourless liquid, of an odour resembling that of bitter almonds, and the sulphocyanate of acetyl, C_3H_5NOS.

On Camphic Acid.—J. de Montgolfier.

Isomers of Camphor and Borneol.—J. de Montgolfier.—These two papers are not suitable for abstraction.

Mineral Cotton.—H. Meidinger.—This substance, used for coating boilers, steam-pipes, &c., to prevent cooling, is made by passing a current of steam through melted slag. The utmost length of the fibre is 5 c.m. It is a very bad conductor of heat, whence its application. Its price is 7½ francs per 50 kilos.—*Chem. Centralblatt.*

Improvements in Producing Aniline-Black in Dyeing and Printing.—R. Pinckney.—In dyeing the author steeps the goods in the following ingredients, either all together, or first in the solution of the metallic salts, and then in the salt of aniline and the chlorate:—

Hydrochlorate of aniline	150 parts
Salt of uranium or vanadium ..	18·5 „
Chloride of nickel	20 „
Chlorate of potash..	100 „
Water	2500 „

The goods may be dyed either cold or hot. In printing, the proportions employed differ in the chlorate, which varies from 150 to 100 parts, and in the water, which is reduced to 1200 parts. The mixture is thickened with gum or dextrin.—*Moniteur de la Teinture.* [We fear these mixtures will prove too costly for use.]

Formation of Aniline-Black by the Electrolysis of its Salts.—J. J. Coquillion.—Taken from *Comptes Rendus*, lxxxi., p. 408, and already noticed.

M. Reimann's Farber Zeitung, No 4, 1876.

According to R. Wagner resorcin mixed with solution of sulphate of copper, and enough ammonia to re-dissolve the precipitate which is at first produced, yields a deep black liquid which dyes wool and silk, and which may possibly be used as black ink.

Adulteration of Eosin.—Eosin has recently been discovered to be sophisticated with starch, which is less easily recognised than sugar when the sample is treated with water. It is therefore recommended to drench a portion of the eosin with alcohol at 96 per cent, which ought to give a clear solution. The absence of other red colouring matters is ascertained afterwards.

To distinguish eosin from the coal-tar colours, and from alizarin-red, Wagner proposes to moisten the tissues with collodion. If a white spot appears the dye employed is eosin.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

Improvements in artificial stone. J. C. Sellars, Birkenhead, Chester. December 7, 1875.—No. 3911.—This relates to that class of artificial stone made into blocks, bricks, tiles, or other forms by subjecting to pressure or by moulding into form mixed siliceous sand or other granular substances and Portland or other cement, powdered lime, or clay, and consists essentially as means for hardening and rendering sand stone more durable, in wetting or soaking the said blocks, bricks, tiles, or other forms after pressure or moulding, and after they have been exposed to the atmosphere for some time, with or in water containing or holding lime in solution or suspension.

Improvements in the manufacture of gas. R. P. Spice, Parliament Street, Westminster. December 18, 1874.—No. 4365. This invention relates to the manufacture of illuminating gas when what is commonly known as "water gas" is used in combination with the vapour of petroleum or other similar spirit or oil. The apparatus to be employed is not necessarily, but greatly by preference, that for which Letters Patent, No. 4178, dated December 13, 1875, were granted to me; and the present improvements consist in causing the gas immediately after it has left the condenser, or direct from the retorts, and while it is hot, to pass through a vessel containing petroleum, whereby not only the light but the heavier spirits are vapourised and caused to combine with the water gas. By these means, in conjunction with those described by me in a Provisional Specification, No. 3269, dated September 24, 1874, the whole of the vaporizable portion of the ordinary petroleum of commerce may be utilised, and the object of the present invention attained. The gas after passing through the petroleum may be conducted to the condenser if necessary, and subsequently to the purifying and storing apparatus in the ordinary way.

Improvements in the processes of and apparatus for treating and purifying the refuse "pickle" of tin-plate works, also in treating the sulphuric acid obtained, and in purifying the "scouring-water" used at such works. W. J. Pughsley, Kidwelly, Carmarthen. December 29, 1874.—No. 4373. This invention relates to certain improvements in connection with the invention for which Letters Patent were granted to me on the 21st day of June, 1864, No. 1530. In lieu of bottling the sulphuric acid obtained from the refuse "pickle," according to my said invention, direct from the lead tank for the use of the picklers, by the present improvements I cause it to run into the upper compartment or cistern of a filter through a lead receiving pipe, and from which it escapes (through a coarse flannel strainer having a perforated copper plate at its top) to and permeates a deep layer of charcoal in the lower compartment, and then through a layer of small pebble stones obtained from fresh water, and lastly escapes from the filter through a perforated wooden chamber, and a wood tap fixed therein, into a glass bottle, and it is then ready for re-use by white or black picklers as previously. The discolouration of rivers or other stream-water adjacent to tin-plate works is caused by the "scouring water" used at such works, in a tank containing which the plates are placed, after having been taken out of the "pickle," until the acid is removed from them. To prevent this discolouration I construct a filtering apparatus in the watercourse of the "scouring-water," and cause the latter to pass first through a layer of limestone, which will retain any dirt that may have accumulated. The filter I construct of bricks, and form it of an upper layer of charcoal separated by a perforated elm plank from a lower layer of burnt bones. The bones absorb the acid, and prevent any from escaping to the stream. The white pickle I run into a tank (instead of into the river or stream), in which I allow it to settle, and subsequently over into a filtering apparatus of the construction hereafter described, and thence to the black plate picklers to be re-used, mixed with best vitriol. Subsequently I cause all the black and white pickle to pass through the processes described in the Specification of my above referred to Letters Patent, so as again to obtain the sulphuric acid for re-use. The tank lastly above referred to may be made of brick, or of any suitable substitute, such as a palm-oil cask, arranged so as to receive the pickle from the pickler's pot. The filtering apparatus I construct of wood, with a filtering medium of charcoal only. I also provide it with a wood tap, by which the filtered acid can be withdrawn for the black picklers.

New or improved apparatus which may be used for condensing vapours or gases, for heating liquids, for purifying and bleaching oils and gases, and for other analogous purposes. R. Speir, Greenock, Renfrew, N.B., and J. Mather, Gateshead-on-Tyne, Durham. December 21, 1874.—No. 4361. The features of novelty which constitutes this invention is the arrangement and construction of the apparatus.

Improvements in the manufacture of hydrogen gas, and in the utilisation of the by- or secondary product obtained in such manufacture. J. H. Johnson, Lincoln's Inn Fields, Middlesex. (A communication from J. O. E. Moreau, Paris.) December 21, 1874.—No. 4387. This invention relates to the application in the manufacture of hydrogen gas suitable for illuminating and heating purposes of a material not hitherto used in such manufacture, whereby a considerable saving is effected in the cost of production, and (in the case of lighting-gas) greater illuminating power is obtained; and it consists in the employment of the slime or ooze composed of the detritus of floating plants, aquatic vegetables, and the like, which settle on the bed or bottom of rivers, lakes, and similar watercourses or sheets of water, and there collect, forming strata or layers, which in a short time become decomposed. The invention also relates to the utilisation of the by- or secondary products in the manufacture of coke, artificial fuel, manure, and disinfectants.

NOTES AND QUERIES.

*** Our Notes and Queries column was opened for the purpose of giving and obtaining information likely to be of use to our readers generally. We cannot undertake to let this column be the means of transmitting merely private information, or such trade notices as should legitimately come in the advertising columns.

Dry Rot.—Can any of your correspondents inform me if there is any preparation that can be applied to timber in a house to prevent the spread of dry rot, and what is the best method to pursue?—Dry Rot.

Black-Ash Making.—Will some correspondent be kind enough to inform me what weights of salt cake, limestone, and slack are found in practice the best? what is the actual loss of salt cake in black-ash making? and what, if any, is the loss of alkali usually found in lixiviating? What percentage of sodium oxide should be found in an average ball made from whatever is considered to be an average charge?—Enquirer.

MEETINGS FOR THE WEEK.

Saturday, Feb. 12th.—Physical, 3. (Annual General Meeting. Election of Officers, &c.)

Monday, 14th.—Medical, 8.
—— London Institution, 5.
—— Royal Geographical, 8.30.
—— Society of Arts, 8. Cantor Lectures. "Iron and Steel Manufacture," by W. Matthew Williams, F.C.S.

Tuesday, 15th.—Civil Engineers, 8.
—— Zoological, 8.30.
—— Royal Institution, 3. "On the Classification of the Vertebrated Animals," by Prof. Garrod.
—— Society of Arts, 8. (African Section). "Ostrich Farming and the Ostrich Feather Trade of South Africa," by P. L. Simmonds, F.S.S.

Wednesday, 16th.—Society of Arts, 8. "The Combustion of Gas, and its Application to Heating Purposes," by John Wallace.
—— Meteorological, 7. "An Improvement in Aneroid Barometers," by the Hon. Ralph Abercromby, F.M.S. "Meteorology in India in relation to Cholera," by Colonel J. Puckle, M.S.C.
—— Society of Public Analysts, 6.30.

Thursday, 17th.—Royal, 8.30.
—— Royal Institution, 3. "On the Chemistry of the Non-Metallic Elements," by Prof. Gladstone.
—— Chemical, 8. "On some Points in the Analysis of Potable Waters," by Dr. Frankland.
—— Royal Society Club, 6.30.
—— Zoological, 4.
—— London Institution, 7.

Friday, 18th.—Royal Institution, 9. "Action of Light on Selenium," by C. W. Siemens.
—— Society of Arts, 8. Indian Section. "Suez Canal," by C. Magnac.
—— Geological, 1. (Anniversary).

Saturday, 19th.—Royal Institution, 3. "On the Vegetable Kingdom," by W. Thiselton Dyer.

ROYAL SCHOOL OF MINES.

Prof. RAMSAY, LL.D., F.R.S., will commence a Course of Forty Lectures on GEOLOGY, on Monday next, February 14, at Two o'clock, to be continued on each succeeding Tuesday, Wednesday, Thursday, and Monday at the same hour. Fee for the Course £4.

Mr. WARINGTON W. SMYTH, F.R.S., will commence a Course of Forty Lectures on MINERALOGY on Monday next, February 14, at Noon, to be continued on each succeeding Tuesday, Thursday, Friday, and Monday at the same hour. Fee for the Course £4.

TRENHAM REEKS, Registrar.

Silicates of Soda and Potash in the state of Soluble glass, or in CONCENTRATED SOLUTION of first quality, suited for the manufacture of Soap and other purposes, supplied on best terms by W. GOSSAGE and Sons, Soap Works, Widnes, Lancashire.
London Agents, CLARKE and COSTE, 19 and 20, Water Lane Tower Street, E.C., who hold stock ready for delivery.

F. W. HART, Manufacturer and Dealer in Apparatus and Chemicals for Scientific Pursuits. Laboratory Fitter and Furnisher. Photographic Apparatus and Materials 8, Kingsland Green (West Side), London.

THE CHEMICAL NEWS.

VOL. XXXII. No. 847.

NEW SULPHURETTED HYDROGEN GENERATOR.

By P. CASAMAJOR.

THE gas generator, which it is my purpose to describe here, has been in use for several months. It possesses two important characteristics, which, as far as I am aware, are not found combined in any apparatus suitable for producing large quantities of gas. These characteristics are:—

1. That it gives sulphuretted hydrogen immediately whenever it is wanted.
2. That it does *not* give it when it is *not* wanted, except for a few minutes after being used.

Kipp's apparatus, which is the one most generally used for the production of sulphuretted hydrogen, fulfils the condition of being ready to give off the gas at any time, but it has the drawback of being an almost constant generator of gas, which defect is inherent to its construction. One cause of this is that the sulphuret of iron is placed on a wire gauze directly over the dilute sulphuric acid in the lowest globe, and that it keeps falling through and around the wire gauze, causing a constant production of gas, which must eventually escape either through the glass stopcock, or through the safety tube on top of the highest globe.

Another cause of the constant production of gas is that, when the stopcock is closed, the dilute sulphuric acid is driven back to a height of about 15 inches. This maintains a pressure in the apparatus which forces the gas out at some part of the ground joints. After a certain portion of the gas has escaped, the dilute sulphuric acid rises in the lowest globe so that it reaches the sulphuret of iron on the sieve, and a fresh supply of gas is produced, driving the liquid to the upper globe as before, and re-establishing the pressure in the apparatus.

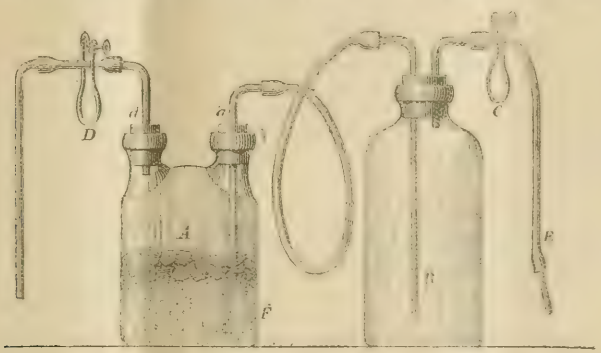
The use of Kipp's apparatus having been found inconvenient, I adopted for several years the plan of putting up an apparatus when one was wanted, emptying it out again when not required for use. This generator was merely a bottle with two tubes, one for the egress of the gas, and the other for the introduction of dilute sulphuric acid, which latter served also as a safety tube.

This plan is troublesome and inconvenient. If particular care is not taken to wash the sulphuret of iron with water and weak carbonate of soda, and drying it well before putting it away, it will be found oxidised and useless when wanted.

Besides these two generators, which are in general use, others have been proposed, of which I can say that those which have come under my notice have either failed in the important requisite of ceasing to give sulphuretted hydrogen when it is *not* wanted, or are ill adapted to the production of gas in any considerable quantity.

The new apparatus for generating sulphuretted hydrogen is represented in the woodcut accompanying this article. The bottle marked A is provided with two tubulures, through one of which passes a glass tube, ending at its lowest part in an enlarged portion F, which must, however, be narrow enough to pass through one of the tubulures of the bottle A. This tube must pass through a rubber cork capable of closing the tubulure *a* perfectly.

Before introducing the tube through the tubulure *a*, the enlarged portion is filled with some coarse fibrous material, such as coarse tow. After the tubulure *a* shall have been perfectly closed by the rubber cork, a quantity of shot (about No. 3) is poured into the other tubulure so that it will rise in the bottle to a height of two or three inches. After levelling the shot, pieces of sulphuret of iron are introduced in the bottle, where they will lie on top of the shot.



The presence of shot in contact with the lower part of the tube before mentioned accounts for the necessity of providing this tube with an enlarged portion F, as by this means sufficient space is left for the passage of liquid between the grains of shot, which otherwise would close almost entirely the lower end of the tube. The object of stuffing the enlargement F with tow is to prevent the shot from rising up to the narrow portion of the tube.

After the shot and sulphuret of iron have been introduced, the other tubulure *b* is closed tightly with a rubber cork provided with a tube to lead the gas generated to a wash bottle. The two portions forming the outlet tube are united by a rubber tube, which may be entirely closed by means of the screw pinchcock D.

The bottle B is provided with a wide mouth, bearing a rubber cork with two tubes, one of which extends down to the bottom of B and communicates by means of a flexible rubber tube to the glass tube which enters into the bottle A through the tubulure *a*. The other glass tube of bottle B terminates in a flexible rubber tube which may be tightly closed by means of the pinchcock C. The bottle B is filled to about two-thirds of its height with dilute sulphuric acid, which is allowed to go to the bottle A whenever the gas is to be generated, and which

returns to the bottle B when the apparatus is not in use.

To generate sulphuretted hydrogen with this apparatus, we may observe that if the tubes by which the bottle A communicates to the bottle B are full of liquid, it will merely be necessary to open the screw pinchcock D, which will remove the pressure from the bottle A and allow the dilute sulphuric acid in bottle B to flow into bottle A. If these tubes of communication, including the flexible tube, are not full of liquid, the screw pinch D should be kept open, and air be driven into the bottle B from the mouth through the tube E by opening the pinch-cock C. The pressure exerted in this way on the surface of the bottle B drives the liquid it contains into the tubes of communication, and, after the blowing of air through the tube E has ceased, the liquid continues to flow into A until it reaches the sulphuret of iron, when sulphuretted hydrogen is given off.

On account of the offensive nature of the gas, care should be taken not to draw air from the bottle B into the mouth. This is easily avoided by filling the mouth and lungs with air before blowing into the bottle B. If care is not taken to open the screw pinchcock D before blowing, the gas in the bottle will not be driven forward, but will be mixed with the air from the lungs, and partly find its way into the mouth of the operator. This screw pinch-cock D is specially useful in regulating the outlet of sulphuretted hydrogen, and consequently its production.

When no more gas is wanted the screw pinchcock should be closed entirely, after which a certain pressure is produced in the apparatus from the gas which continues to be formed. After a minute or two the pinchcock C should be opened to remove the pressure from B, and allow, not only the liquid in A to flow back into B, but also a certain quantity of gas, by which means the liquid connection between the two bottles is interrupted, and remains so while the apparatus is not in use.

471, Lafayette Avenue,
Brooklyn, December 20, 1875.

ON THE USE OF THE SPRENGEL VACUUM PUMP FOR FILLING BAROMETER AND THERMOMETER TUBES WITH MERCURY.

By ERNEST FRANCIS,
Government Laboratory, Trinidad, B.W.I.

THE difficulty of filling tubes with mercury so that air may be excluded is well known, and instruments in which this condition is attained are highly prized. The ordinary process of filling barometers by boiling is tedious and unsatisfactory, more especially to those unused to the operation.

It has been found that the improved form of the Sprengel pump affords an admirable means of accomplishing the operation, and adds another to the numerous good qualities for which the instrument is famed. The process is easy and would enable barometers to be filled in the laboratory with perfect accuracy. It has the additional advantage of being applicable to tubes of any calibre.

The operation is performed by connecting and exhausting the barometer tube; the outflow orifice of the pump being then stopped, mercury passes in and fills the exhausted tube.

Further details may be gathered from the accompanying diagram, but the arrangement would vary slightly with the shape of the tube to be filled. The diagram shows a Bunsen's syphon barometer, connected to the pump at A by vulcanised tubing, with the joint surrounded by a tube filled with mercury. After exhaustion the end of the pump C is closed either with the finger or by a specially furnished clamp or stopcock. The mercury which is kept flowing from the reservoir then ascends and completely fills the barometer. The mercury falls over the bend to the point B, but without sufficient force to break the tube. The inflow of mercury is regulated by the clamp D. When full the barometer can be safely disconnected with a little care, and the excess of mercury poured out. For filling straight tubes the part A can be bent and connected to the barometer inclined downwards. It is almost needless to add that the barometer during the filling must be supported by a clip or otherwise.

A barometer filled in this manner answered every test most satisfactorily. The tube became completely filled with clear bright mercury, no trace of air being visible at any part. Tested by repeated gentle tiltings it gave no dull sound, and finally the vacuous part being surrounded by hot water, produced no alteration in the height of the mercurial column.

In conclusion I would suggest that the same process might prove satisfactory for filling *thermometer* and other tubes with mercury.

December 30, 1875.

ON THE NATURE AND ORIGIN OF METEORITES.

By DR. MOHR.

OF this long and valuable memoir we can only insert a few portions:—

If we compare all the facts it appears as the final result that the meteoric silicates and iron masses have been formed simultaneously in the moist way, and the iron by reduction effected by organic bodies. The reasons for this view are as follows:—

1. The silicates contain small quantities of water.

2. The silicates decrease in specific gravity by strong heating and fusion.

3. Different silicates are crystallised together; some parts being soluble in hydrochloric acid, and other parts are not, as in basalts and phonolites.

4. The olivin, containing protoxide of iron, is green, and not black.

5. The igneous crust is black in contradistinction to the interior of the meteorite.

6. Certain meteorites contain organic bodies, analogous to terrestrial hydrocarbons.

7. Meteoric iron contains no chemically combined carbon, even when graphite is present.

8. The sulphide of iron is contained in single particles distinct from the iron, and not diffused through the whole mass.

9. Schreibersite, composed of phosphorus, iron, and nickel, is likewise found in distinct particles.

10. Brittle meteoric iron becomes soft by ignition if no sulphide of iron is present.

11. Malleable meteoric iron, containing sulphide of iron, becomes hot-short on fusion.

12. Meteoric iron, if heated to whiteness in a vacuum, evolves hydrogen.

13. The "Figures of Widmannstätt" give proof of an undisturbed crystallisation.

14. No silicium is present which agrees with theory, since silica cannot be reduced by organic bodies.

The author here solicits possessors of meteorites to forward him small fragments, &c., of no value as specimens, for the purpose of extending his observations. He next proceeds to the question of the origin of meteorites.

The view formerly maintained that they were projectiles from the moon, in which it was supposed that volcanoes were recognised, is quite untenable. It is fatal to this theory that the meteorites coincide with the periodically recurring swarm of shooting stars, which have a planetary orbit in space, and also, that, as appears from the above, they display no igneous structure, and cannot, consequently, have sprung from a volcano. That such things can have been formed in the air is a notion* built of air.

The constituents of meteors, such as olivin, augite, anorthite, and their organic matter prove that these bodies must have been formed upon a planet, warmed by the sun, or by a sun in absolute rest, and in the lapse of an enormous length of time, like the terrestrial silicates. Under what circumstances this planet has been shivered in fragments does not appear. It must have had a large collection of waters, a sea, which has likewise been dispersed, and which now is to be found in meteoric swarms, and in comets, as already shown.

The author maintains with Galle and Förster (see *Pogg. Annalen*, 148, 172) that the shooting stars of November 27, 1872, consisted of particles of Biela's comet, whose orbital plane was intersected by the earth at that precise time, and whose direction agreed within a degree with that of the meteors.

It is striking that such cosmic bodies as we can take in hand and examine, namely the earth and meteorites, show not the smallest trace of an igneous formation if we regard volcanoes, and the fiery crust of meteorites as subsequent modifications, and not as original features.

The peculiarity of meteorites as compared with our globe, consists in the circumstance that we find in the former more products of reduction, and except the earths, no perfect oxides. Thus in meteorites we find no ferric oxide, but metallic iron, sulphide of iron, and phosphide of nickel-iron. Upon our globe phosphorus occurs only as phosphoric acid. Hence the hypothetical planet where the meteorites originated must have been smaller than our globe, and have had a less dense atmosphere containing less free oxygen. The sp. gr. of most meteorites, 3·275, agrees with the calculated density of the planetoids between Mars and Jupiter.

Dr. Mohr does not accept the view of J. R. Meyer that the heat of the sun is maintained by the infall of meteorites. He considers that in an infinite universe, filled with radiating suns, our sun can lose nothing which it does not receive back every moment from its fellows, since the void space of the universe has been for infinite ages filled with that sum-total of rays which it is capable of receiving.—*Liebig's Annalen der Chemie.*

* "Aus der Luft gegriffen,"—a common German phrase for any view lacking a substantial basis.

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 58.)

For the generation of cold by evaporation liquids are most suitable which require a technical preparation and possess a considerable value. In the manufacture of ice on the large scale it is therefore needful to restore the escaping vapours to their original condition, *i.e.*, liquids capable of re-evaporation so that a given quantity of material may serve again and again, circulating continually. This restoration can be effected by two processes different in form and action of which the ether machine and the ammonia machine are respectively almost the sole existing representatives.

The ether machine is arranged as follows:—A double-action air-pump worked by some especial source of power (generally a steam-engine) draws incessantly the vapour of ether out of a vessel filled with liquid ether (ice-generator or evaporation-receiver.) By the return of the piston the vapour is compressed and driven into a worm cooled by water. As the vapour which has been heated by compression cools, it condenses to a liquid which is collected in a suitable vessel whence it is driven by the pressure of the condensed vapour back into the evaporation-receiver where it recommences its function.

The principle of the ether machine was patented in England by Jac. Perkins, of London, as early as 1834. His apparatus contains all the parts requisite for continuous action—evaporation-receiver, air-pump, and worm-condenser. The first-mentioned part, according to the drawings, consists of a vessel like a boiler formed of two segments of a sphere and surrounded with water. This arrangement is not very suitable, possibly the reason that nothing further has been heard of the development of the apparatus. Or, possibly the time was not yet come for the utilisation of the principle, the demand for ice being not important enough to render it a remunerative business.

The next patent for an ether ice machine was taken out in 1856 by John Harrison, of Geelong, in Victoria. In September, 1857, he obtained a patent for improvements, according to which latter the machine is arranged as follows:—The evaporator has the form of a horizontal tubular boiler, with numerous narrow tubes. Through these tubes a concentrated solution of common salt which is pumped up at the top streams down in a zigzag direction, the tubes being divided in three sets from above downwards. The ethereal liquid streams out of the condenser into the boiler outside the tubes. The solution of common salt passes from the boiler into a long tank in which are suspended vessels of the water to be frozen (ice-boxes), passes through it, and is pumped up again into the boiler. The arrangement is perfectly rational. Harrison states in his specification that he can, by means of his machine, produce a temperature of $-29°$; but from an economical point of view he prefers $-2°$ to $-5°$. The process of freezing is then slower, but the expenditure of power is much less, and the ice is transparent like natural ice. At the end of the year 1859 Lawrence established works at Liverpool for the production of artificial ice, and sold it at one halfpenny per lb. Dullo† and Grünberg‡ have described the process, the latter with illustrations. From 40 to 60 cwts. of ice were prepared daily by means of a steam-engine of 15 horse-power. In 1860 Laboulay§ described an ether ice machine by F. Carré, of Paris. In

* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzehends."

† Dullo, *Dingl. Journ.*, clviii., 115.

‡ Grünberg, *Pol. Centralbl.*, 1863, 656.

§ Laboulay, *Bull. Soc. d'Enc.*, 1860, 129.

it the other acted directly upon the water to be frozen.* It was soon abandoned by Carre after he had succeeded in carrying out the ammonia machine, which is far more efficacious. In March, 1862, Dr. Siebe, of Lambeth, obtained an English patent for an improved ice machine. The general arrangement is the same as Harrison's. The boiler, instead of being horizontal, is vertical. There are also changes in the air-pump and the cooler, which do not affect the principle. The ice-boxes are so arranged that when the first one, which is exposed to the influx of the cold liquid, is frozen and taken out the entire series slides forwards, and the new box filled with fresh water comes in last. From this date we find Siebe's name alone connected with the machine in question, which, however, is still spoken of as Harrison's principle. Siebe's machine figured at the London Exhibition of 1862.

(To be continued.)

THEORY OF THE

PRODUCTION OF ANILINE-BLACK BY MEANS OF THE SALTS OF VANADIUM.

By M. A. GUYARD (HUGO TAMM).

SINCE the interesting discovery of M. Pinkney is known it may be permissible to say a few words on the question of the formation of aniline-black, hitherto obscure, but which the reaction of the salts of vanadium completely elucidates.

If we introduce into a normal mixture for aniline-black, made up of water 100 grms., hydrochlorate of aniline 8 grms., chlorate of potash or soda 3·5 to 4 grs., about 1 centigrm. of vanadous chloride or vanadate of ammonia, we see with surprise the liquor darken in a few moments, and then gradually deposit an abundant precipitate of aniline-black. After about forty-eight hours the reaction is nearly complete, and the liquor is taken up in a thick paste, almost solid, in consequence of the formation of almost all the aniline-black which it is able to furnish. This reaction is so delicate that 1 part of vanadous chloride transforms 1000 parts of hydrochlorate of aniline into aniline-black, and that in practice 500 parts may be thus advantageously transformed by 1 part either of the chloride or of the vanadate of ammonia. This important discovery renders dyeing with aniline-black as easy as printing, and nothing can equal the beauty of the blacks thus obtained. Since the discoveries of Lightfoot and Lauth there is no reaction which is calculated so much to generalise the use of aniline-black both in dyeing and printing.

But this reaction is chiefly interesting in a chemical point of view. It is one of the most elegant reactions of chemistry. The author thinks he may give its true image by saying that the vanadium is a *fluid* spark which determines the combustion of the fluid mass of salts of aniline and of chlorate. We make aniline-black by means of a drop of a salt of vanadium, just as we set fire to fuel by means of a match. The power of the vanadium salts in the production of aniline black is more than a thousand times greater than that of copper. The reason of this is intelligible if we know the properties of vanadium. There is no metal which passes more readily from the lowest to the highest stage of oxidation and returns again to the lowest. Under the feeblest reducing influences vanadic oxide becomes vanadous oxide, and under the faintest oxidising influences vanadous oxide is re-converted into the vanadic. This is the whole secret of the power of vanadium—a power so great that the author thought at first he had encountered a new force, or at least one of those mysterious agencies named catalytic; but a closer study of the phenomenon soon led to its explanation. In fact, on dissolving vanadic acid in hydrochloric acid it is transformed into vanadous chloride, and on evaporating the latter in the air it is partly transformed into vanadic acid. On the other hand, if vanadous chloride and chlorate of potassa are brought in contact, the latter is decomposed with disengagement of chlorine, and the vanadous oxide is transformed into vanadic oxide. Reciprocally, if we introduce vanadic oxide, or an alkaline vanadate, into hydrochlorate of aniline, the vanadous oxide is instantly reduced to the state of vanadous oxide or chloride. If we introduce into a mixture of an aniline salt and of a chlorate 1-1000th of vanadous chloride or of a vanadate aniline-black is produced with the same energy. In fact, in the twofold contact with the oxidising salt and the reducing organic compound the vanadium passes with the speed of an electric spark from the state of vanadic acid to that of vanadous oxide, and reciprocally as long as there remains a trace of aniline to oxidise or of chlorate to decompose.

In order that a metal may aid in the production of aniline-black it must possess at least two degrees of oxidation in the moist way. Thus potassium, sodium, lithium, calcium, magnesium, barium, aluminium, zinc, cadmium, lead, silver, and all analogous metals, are incapable of taking part in the production of aniline-black.

But if a metal has two stages of oxidation in the moist way, it must not pass with too great facility from one of these states to the other.*

Thus protochloride of tin is improper for the preparation of aniline-black. In fact this salt absorbs oxygen and chlorine with such avidity that it decomposes a certain quantity of chlorate of potash, but it absorbs the products of the decomposition, and does not yield even the smallest portion to the aniline. We may thus, at pleasure, retard the formation of aniline-black, even in mixtures containing vanadium. The formation of aniline-black does not begin till all the tin is peroxidised, and when the black makes its appearance it can be made to disappear again by adding fresh quantities of the protochloride of tin. If we take the higher oxide of a metal having two stages of oxidation we may produce bodies analogous to aniline-black, provided that the salt passes readily to the lower oxide. Thus, permanganate, bichromate, ferrate of potassa, and bivanadate of ammonia form with hydrochlorate of aniline bodies analogous to aniline-black, and that without the intervention of chlorates. Alkaline tungstates and molybdates are not favourable to the production of blacks. If we take the lower oxide of a metal having two stages of oxidation we may, in presence of chlorate of potash, obtain aniline-black. The lower oxides of cerium, iron, and manganese are here included, as well as those of nickel, cobalt, and chrome. These latter become peroxidised with difficulty, and are not very fit for the purpose, but in presence of 1-5000th of a salt of vanadium they aid in the formation of black.

The lower oxides of uranium, tungsten, and molybdenum, yield alone very fine blacks. But the higher oxide of uranium, like the tungstates and molybates, does not act. When the salts of uranium seem to form black, as M. Pinkney considers that he has observed, it is because the salt of uranium has been obtained from a pitch blende containing vanadium.

Copper passes readily from the maximum to the minimum state of oxidation, and still more readily in the inverse direction: consequently, next to vanadium, it is the metal best suited for the production of black, and the one generally employed.

The quantity of salt of vanadium necessary to transform aniline into black is so small that it may be practically disregarded. Hence we infer that metallic salts, though necessary in the formation of aniline-black, do not enter into its constitution. Aniline-black with vanadium is identical with aniline-black with copper, the one containing no vanadium, and the other no copper.

M. Coquillion states that he has obtained aniline-blacks

* *Dingl. Pol. Journ.*, clviii., 109.

* This seems scarcely consistent with the previous passage, where the author states that "no metal passes with more facility from the minimum to the maximum state than vanadium."

by electrolysis. The author has obtained them still more readily by introducing into a very concentrated solution of a chlorate and of a salt of aniline a few drops of hydrochloric acid. No metal intervenes, but the hydrochloric acid decomposes the chloric acid; and the products of this decomposition, reacting upon the aniline, transform it into black. In some hours the mass becomes a well characterised paste of aniline-black.

This reaction is of no practical service, because the goods would be destroyed by the concentrated and acid liquids. Nevertheless, it proves that the salts of vanadium and copper serve merely to play in dilute liquids the same part which hydrochloric acid does in concentrated solutions. We may say without hesitation that aniline-black is the result of the action of the decomposition products of chloric acid upon aniline.

The reaction of vanadium enables us to study the behaviour of these decomposition products of chloric acid upon a number of organic bodies, and upon the isomers of aniline. Starch, dextrin, and isinglass are converted into pale yellow substances which do not dye. Extract of logwood, if treated with chlorate of potash and a drop of a salt of vanadium, is transformed into a yellow substance, which dyes silk a splendid gold-yellow. Under the same circumstances the solution of hydrochlorate of toluydin (made from solid toluydin) is transformed into a new substance, which dyes silk a pleasing bronze with coppery lustre.

All these reactions are plainly due to the decomposition products of chloric acid, and have all been reproduced with the substitution of copper for vanadium. However, copper has to be employed in proportions from 1000 to 1500 times greater than vanadium to obtain the same results. Chloride of vanadium is indirectly the best reagent for aniline, and, conversely, a mixture of hydrochlorate of aniline and chlorate of potash is the best reagent for vanadium. If the substance supposed to contain aniline is evaporated with a slight excess of hydrochloric acid, adding chlorate of potash and a drop of a weak solution of vanadous chlorate, aniline-black makes its appearance whatever foreign bodies may be present. (Protochloride of tin?)

On the other hand, the presence of vanadium may be detected by concentrating the solution, acidifying with hydrochloric acid, and treating with a mixture of a salt of aniline and a chlorate. If aniline-black is formed rapidly in the cold the presence of vanadium is a certainty.

The author draws the following conclusions from his examination of aniline-blacks:—

Aniline-black is simply emeraldin dehydrated.

An elevated temperature in the ageing-rooms is necessary, not to form emeraldin, but to dehydrate it, and convert it into black.

Emeraldin may be dehydrated by the application of heat, even in the liquid in which it is formed. In other words, emeraldin is transformed into aniline-black just as the blue hydrous oxide of copper is converted into the black anhydrous oxide by ebullition.

The essential characteristic of hydrated aniline-black, or emeraldin, is that it can be completely dissolved or destroyed by the yellow sulphide of ammonium.

The essential characteristic of anhydrous emeraldin, or fixed aniline-black, is that it is very slightly affected by the sulphide of ammonium. This reagent always points out whether emeraldin has or has not been transformed into black.

The characters just recited are those of the blacks produced from chemically pure aniline—the finest blacks which can be obtained.

The blacks prepared from commercial anilines are formed of emeraldin, mauvein, violanilin, and toluydin bronze.

If the commercial anilines are completely oxidised, the aniline is converted into emeraldin, and the toluydin into bronze. The mauvein and violanilin disappear almost entirely, and the emeraldin, being insoluble in acids and alcohols, may be separated from the toluydin bronze, which is soluble in the same liquids.

By means of this reaction aniline in commercial aniline oils may be determined, being thrown down as emeraldin, and weighed as aniline-black.

Typical aniline-black is anhydrous emeraldin, but in practice there are as many aniline-blacks as there are mixtures of aniline and its homologues.

The liquid toluydins of commerce behave like mixtures of aniline and of crystalline toluydin, and yield with chlorate of potash and vanadium mixtures of emeraldin and toluydin bronze.

Vanadium will render great service to organic chemistry, and will revolutionise the preparation of aniline-black.—*Bulletin de la Société Chimique de Paris.*

PROCEEDINGS OF SOCIETIES.

PHYSICAL SOCIETY.

Annual General Meeting, February 12, 1876.

Professor GLADSTONE, F.R.S., President, in the Chair.

THE following candidates were elected Members of the Society:—Mr. W. R. Hodgkinson and Mr. H. M. Hastings.

The PRESIDENT read the Report of the Council, of which the following is an abstract:—

The Council points with satisfaction to the activity with which the work of the Society has been carried on during the year, as is shown by the number of papers read; and special reference is made to Lectures which were delivered by M. Cornu, of Paris, and Mr. J. Norman Lockyer. The election of many distinguished physicists during the past year has given the Council much satisfaction, as it affords undoubted evidence of the progress of the Society and of the position it has now attained. The Society has to regret the loss of two members—Mr. Becker, who died on the 3rd of April, 1875, from bronchitis, in the 54th year of his age; and Mr. Waugh, who died on the 12th of October, from epilepsy, in his 40th year. The Society has already published a work by Prof. Everett, on the Centimetre-Gramme-Second System of Units; and the Council is now in communication with the family of the late Sir Charles Wheatstone, with a view to the publication of his papers. Attention is drawn to the benefit which the Society derives from the use of the lecture-room, &c., which were generously placed at its service by the Lords of the Committee of Council on Education. It has been considered desirable to arrange that the Council may grant admission to all meetings of a Session to approved persons who are not members of the Society. In concluding, the Council records its thanks for the services which Dr. Guthrie has rendered in his office of Demonstrator,—an office which was formerly an important one in the Royal Society,—and the Council believes that much might be gained if arrangements could be made for reproducing before this Society the experiments described in original papers which appear from time to time in this country and abroad.

Several alterations in the Bye-Laws were then discussed and adopted, and the following Officers and Council were elected for the ensuing year:—

President—Prof. G. C. Foster, F.R.S.

Vice-Presidents—Prof. W. G. Adams, F.R.S.; and W. Spottiswoode, LL.D., F.R.S.

Secretaries—A. W. Reinold, M.A.; W. C. Roberts, F.R.S.

Treasurer—Dr. E. Atkinson.

Demonstrator—Dr. F. Guthrie, F.R.S.

Other Members of Council—Latimer Clark, C.E.; Prof. A. Dupré, F.R.S.; W. Huggins, D.C.L., F.R.S.; Prof. H. M'Leod; Dr. C. W. Siemens, D.C.L., F.R.S.; Dr. H. Sprengel; Dr. W. H. Stone; Sir William Thomson,

LL.D., F.R.S.; Prof. W. C. Unwin, B.Sc.; and E. O. W. Whitehouse.

The proceedings then terminated with votes of thanks to the President, the Lords of the Committee of Council on Education, the Demonstrator, Secretaries, and Treasurer.

NOTICES OF BOOKS.

Food; its Adulterations, and the Methods for their Detection. By A. H. HASSALL, M.D. London: Longmans, Green, and Co.

SETTING aside those estimable gentlemen who revere sophistication as an *avatar* of their great goddess, competition, authorities on the adulterations and impurities of food and water may be divided into two schools. One of these—which we shall take leave to call the sensational—loves to go the very extremity of the truth, and to make statements, not perhaps overcoloured, but at any rate very hard to prove: it lays down hard and fast lines defining what is permissible and what is to be branded as impure, and proposes very stringent measures for the repression of the evil. The other, or common sense school, adopts a totally different system: its adherents keep well within the truth in their statements as to the nature and the extent of adulteration; where there is even the shadow of a doubt they prefer to be silent: they are content, for the present, to attack the grosser, more dangerous, and more distinctly characterised forms of sophistication, and seek gradually to educate the public mind up to a sounder view on commercial purity. Which of these two systems is best adapted to the real exigencies of the case there can be little doubt. Dr. Hassall unfortunately shows a leaning to the former school, which may possibly explain his evident sympathy for the late Rivers Pollution Commission.

The work before us reaches the goodly extent of 896 closely-printed pages. But we shall be greatly mistaken if we suppose that the whole of this matter consists of plain directions for the detection and estimation of impurities in articles of food and drink. The strictly analytical portion is so lost among historical matter, controversial passages, descriptions of well-known articles, and outbursts of virtuous indignation, that we cannot help being reminded of Falstaff's tavern-bill with its halfpenny worth of bread to an intolerable deal of sack. Nor can we discover, in the instructions given, much that is at once valuable and new to the chemical profession. This is the more to be regretted since the author informs us, in his preface, that during the last eighteen years he "has been unceasingly occupied with the subject, and has made numberless analyses." A few passages require our more especial notice. In his comparison between the methods of Frankland and Wanklyn for the analysis of water, Dr. Hassall states—"Frankland's method has a real scientific basis; it is good and sound in principle." How any method can be pronounced "good and sound" where the amount to be determined lies within the limits of error we have yet to learn. In the section on coloured confectionery we find indigo enumerated both among the permissible and the dangerous colours. Suppose this work falls into the hands of a conscientious confectioner, anxious not to poison his customers, which of these two conflicting statements is he to accept? Litmus, we are told, is frequently adulterated with "common arsenic and peroxide of mercury." To what purpose are these unlikely substances added? If such a sophistication really happens, why not make use of orchil, which is certainly free from poisonous ingredients?

On the detection of foreign fats in butter Dr. Hassall speaks with much confidence. We fear—judging from a case lately before a police-court—that we are still far from certainty on this important point.

On the detection of alum in bread the author observes—"The perusal of all that has been written on this subject would lead an ordinary observer to form the opinion that the detection and estimation [? determination] of alum in bread constituted one of the most difficult processes in chemistry. This is really not so, however, and there are several processes whereby this salt may be estimated with ease and undoubted accuracy. We shall notice only those methods which are the most practical, and at the same time accurate." Easy as the process may be, it is certain that alum has been before now detected where none existed. We think we could point to printed instructions admirably calculated to lead to such a result.

In describing the estimation of total solids in milk, Dr. Hassall says—"We have therefore not found it necessary to make use of a weighed quantity of sand or hydrated sulphate of lime, which were formerly much employed." We were really of opinion that the superfluity of these additions had first been pointed out by another chemist, but from this passage it would seem that Dr. Hassall claims it, and indeed the whole process for the analysis of milk, as his own! This is the more remarkable as he is generally not remiss in stating his authorities. The sections on the lactometer and the creamometer might well, we think, have been omitted.

Perhaps the most valuable portions of the book are the denunciations of the present law on the adulteration of food and drugs, and the facts and admissions which throw so questionable a light on the ability of the chemists now placed as referees over the heads of the public analysts. A feature which we mention with reluctance is the author's quotation of passages in his own praise—*e.g.*, p. 855. What should we think if we came upon some similar extract in Fresenius or Plattner? Among the advertisements of various articles at the end of the book we find twenty displaying Dr. Hassall's certificate of excellence. Such a state of things may be "as it is," but certainly not "as it ought to be," and is assuredly not in keeping with good professional taste.

Year-Book of Pharmacy, with the Transactions of the British Pharmaceutical Conference at the Twelfth Annual Meeting, Held in Bristol, August, 1875. London: J. and A. Churchill.

THE former portion of this work consists of a number of papers extracted from scientific journals and the transactions of learned societies, and arranged under the heads of Pharmaceutical Chemistry, Materia Medica, Pharmacy, and Notes and Formulæ. A number of valuable processes are given for the detection of impurities and adulterations, and for the quantitative examination of substances of pharmaceutical interest. In a paper on the detection of dye-wares, taken from *Dingler's Journal*, we notice a substance designated as "saffron carmine." We conjecture that the translator means carthamin.

The remainder of the volume is taken up with an account of the Pharmaceutical Conference held at Bristol in August last, with reports of the speeches delivered and the papers read on the occasion. These were by no means strictly limited to subjects of direct bearing upon pharmaceutical questions. Thus an interesting paper was given by Mr. Stoddart on the geology and mineralogy of the Bristol district.

Mr. A. H. Allen read a paper criticising what he designated as the "Horsley-Stoddart method of estimating the fat of milk," which gave rise to a somewhat warm discussion. On a former occasion a Mr. Ekin declared that "the dealers in milk on a large scale already looked upon the Public Analysts, he thought rightly, as their very best friends. The analysts had set up an arbitrary standard for milk, and the milk dealers on a large scale availed themselves of it. There was hardly an instance in which the milk was not toned down to the analysts' standard and a large profit thereby made."

Here, therefore, the standard adopted by the Public Analysts is plainly pronounced too low. The complaint

generally made is precisely the opposite—that they have fixed their standard too high, and have thus caused honest tradesmen to be unjustly fined!

In a discussion on the growth of saffron a Mr. Williams made the following interesting statement:—It was believed that the feathers of certain birds lost their colour unless the feathers were kept well oiled, and that if the bird were prevented oiling its feathers the rain would wash out brilliant and delicate colours." We should like to know if other species of birds besides the touraco are here referred to, as, according to recent researches, the colours of many birds depend not on the presence of a pigment, but merely on the optical effects of their structure, just as in labradorite, opal, mother-of-pearl, &c.

We think it is impossible to glance through this volume without being struck with the amount of influence and prestige which have accrued to the pharmaceutists of Britain from union. Will the "analytical and consulting chemists" never follow this example to protect themselves against the encroachments which they suffer on various hands? We have often harped upon this string, but we wish to tune it.

Air and its Relations to Life; being the Substance of a Course of Lectures Delivered in the Summer of 1874 at the Royal Institution of Great Britain. By W. N. HARTLEY, F.C.S. London: Longmans, Green, and Co., 1875.

MUCH labour and very much iteration will be required before our "respectable and intelligent classes" and even the gentlemen who review physical, chemical, and physiological works for the daily press, become possessed of even moderately correct notions on scientific subject. Such being the case, every man who can convey to the public clear and accurate information of this nature "in a light and popular manner" is worthy of high commendation. In the work before us Mr. Hartley gives a very full and correct account of the air in its bearings upon life. Besides the mere narration of facts he has aimed, not unsuccessfully, at imparting to his readers some insight into the methods of scientific research. All this is done in plain language, technicalities being as far as possible avoided. It is, by the way, a remarkable fact that whilst the use of technical language is freely conceded with every trade, every interest, every amusement even, scientific men are accused of seeking to conceal their knowledge from the world if they employ a special terminology.

The subject is not one of mere speculative interest. In the third chapter of the work Mr. Hartley treats of ventilation in principles and practice; of its neglect in most public buildings; of the evil effects of foul air; of the "ground air," or air permeating the soil; and of its passage into our dwellings, as well as of the danger from leaky sewers and gas-pipes.

An irreverent foreigner once observed that there were two subjects on which every Englishman was enthusiastic:—The first was the ventilation of his dwelling; and the second, the conversion of the Chinese. But even if this be true our zeal has not always been accompanied with knowledge, and hence has rarely been crowned with success. Many of our private houses convey the impression of "stuffiness" to anyone entering from the fresh air. Our public buildings, churches, theatres, courts of justice, &c., are simply discreditable. When ventilation is attempted it often consists merely in an abrupt and irregular influx of cold air, "cold" and "fresh" being by some unfortunate usage considered as synonymous. Frequently, too, the supply of fresh air is taken in, at, or near the level of the ground, where there is great possibility of its being contaminated with the "ground air," and the emanations of decomposing animal and vegetable matter.

But ventilation, important as it must be pronounced, is only one of many topics ably handled by the author. We find an account of the discovery of oxygen; of the methods for its extraction from the air; of the discovery and properties of carbonic acid; of aqueous vapour; of atmospheric ammonia; of that chemical Proteus, ozone; of atmospheric germs; and of the great question of spontaneous generation. We can cordially endorse the judgment of a contemporary that "all persons of decent education, be they young or old, may read this book with pleasure and advantage," and we may add that many persons of high education, commonly so-called, are grievously in want of the knowledge which Mr. Hartley conveys in so pleasing a manner.

CORRESPONDENCE.

BUNSEN'S VACUUM PUMP.

To the Editor of the Chemical News.

SIR,—I am sorry that the person who signs himself "F.C.S." in the CHEMICAL NEWS (vol. xxxiii., page 63) has not preceded these letters by his name, so that I might have relieved my mind of any doubt as to the advisability of taking notice of his communication.

When I mentioned "Bunsen's vacuum pump" I wished to convey the idea of the "water pump," the principle of which was partially discovered by Sprengel, and applied by Bunsen for filtering purposes, in distinction to "Sprengel's vacuum pump," which I believe everyone understands to mean the "mercury pump." I think I assumed correctly that every chemist knows the exact history of "Bunsen's vacuum pump," and that Sprengel therefore loses no credit; but "F.C.S." seems to have his doubts about this. Possibly, if I had used the words your anonymous correspondent suggests, he would have found that Torricelli was the first to produce a vacuum by this means, and would have given his "advice" accordingly.

In conclusion, let me advise the person who signs himself "F.C.S." that the next time he criticises he will save the space of your valuable journal, and probably make his communication appear more courteous, by keeping better to the point he wishes to discuss; but "doubtless in this he sins in company with" *some scientific men*.—I am, &c.,

W. THOMSON.

Royal Institution, Manchester,
February 14, 1876.

THE NEW PHASE OF ELECTRIC FORCE.

To the Editor of the Chemical News.

SIR,—I enclose some drawings that may be of service in any experiments you or any of your scientific friends may make with the newly discovered force.

Some excellent experimenters fail to obtain the spark at all, not fully understanding the conditions; they have tried too large magnets, or magnets with too large cores, from which, according to the experiments of Mr. Edison and myself, thus far, the force cannot be obtained. Some fail from insufficient battery power, others from carelessness, and others still from lack of patience.

It is, perhaps, scarcely necessary to say that all the possible conditions by which the force can be developed are not yet fully understood by any one; but thus far the spark has been obtained most conveniently from telegraph sounders converted into self-vibrators, and from small coils of a few ohms resistance.

When the phenomena are once admitted, and it is claimed that they represent any known form of electricity, it seems to me that the burden of proof is shifted, and on that issue it rests with those who make that claim to take some known form of electricity, giving a spark like the spark of this force, and obtain therewith all these phenomena.

Those who hastily conclude that the extra current, or statical electricity of low potential, account for this

spark, form their opinions, I fear, from insufficient study of the subject or inability to look on all sides of it at once. My physiological experiments, which seem to be important and convincing, have not yet, so far as I can learn, been repeated in detail.

The drawings which I enclose were made by Mr. Edison; they are from the advance sheets of a monograph on the subject now in preparation.—I am, &c.,

GEO. M. BEARD.

New York, 39, West 32nd Street.
January 24, 1876.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences. No. 4, January 24, 1876.

Decomposition of Water by Platinum.—MM. H. Ste.-Claire Deville and H. Debray.—If we heat in a glass tube raised to 500° to 600° cyanide of potassium near to a boat full of warm water, a vacuum having been made beforehand, the pressure reaches at most half an atmosphere, and remains constant for some hours. But if we mix with the cyanide of potassium some platinum-sponge hydrogen gas is evolved in quantity, and there is formed a double cyanide of platinum and potassium. The hydrogen is impure, being accompanied not merely with ammonia, but with 4½ to 12 per cent of carbonic oxide. If the heat exceeds dull redness carbonate of ammonia sublimes. A concentrated solution of cyanide of potassium attacks platinum at the boiling-point. The metal is converted into the double cyanide, with an escape of pure hydrogen. Cyanide of mercury dissolved in water is not precipitated by platinum, even at the boiling point; but if a little cyanide of potassium is added mercury is immediately liberated, and combines with the platinum.

Action of Monohydrated Sulphuric Acid upon the Alcohols.—M. Berthelot.—A thermo-chemical paper, not adapted for abstraction.

Application of the Mechanical Theory of Heat to the Study of Volatile Liquids: Simple Relations between Latent Heats, Atomic Weights, and Vapour-Tensions.—M. R. Pictet.—For all liquids the cohesion is constant. The latent heats of all liquids, raised to the same pressure, and multiplied by the atomic weights at the same temperature, give a constant product. The latent heats of all liquids are multiples of the specific heats.

Action of Ammonia upon Rosanilin.—M. E. Jacquemin.—Inserted in full.

Researches on the Constitution of the Gelatinous Substances.—MM. P. Schützenberger and A. Bourgeois.—These researches relate to isinglass, ossein, gelatin, and the chondrin obtained from the costal cartilages of a calf. As in the albumenoid bodies and fibroin, the nitrogen evolved as ammonia on the one hand, and the carbonic and oxalic acids on the other, are in such ratios that the simultaneous production of these three bodies may be considered as connected with the hydration of urea and oxamide.

Action of Cold upon Milk and its Products.—M. E. Tisserand.—The author finds that the cream separates the more rapidly the nearer the milk has been brought to the freezing-point, its volume being also increased. The yield in butter is also greater when the milk has been exposed to a low temperature, when both skimmed milk, butter, and cheese are of better quality (?).

Magnetic Action on the Rarefied Gases of Geissler's Tubes.—M. J. Chautard.—The author states that it is perfectly well known that gases, and even metallic vapours, present spectra which differ according to the conditions in which they are accidentally placed, among which are temperature, pressure, and the combinations in which the substances occur. The experiments which he has made enable him to add to these modifying causes the action of a powerful electro-magnet. He insists that every spectroscopic observer, before attempting to calculate the numerical results of his experiments, should first determine his peculiar personal error.

Spectrum of Nitrogen, and on that of Alkaline Metals in Geissler's Tubes.—M. G. Salet.—The rays described by Schuster have not been found by Stearn and Wüllner. The rays described in the memoir of 1872 may possibly have been due to the vapour of sodium.

Action of Heat in Magnetisation.—M. L. Favé.—The following phenomena have been observed:—The conservation of magnetism at any temperature as long as such temperature is constant; the decrease of the magnetism, slow at first and then rapid, and becoming very rapid at the expiration of a time which varies with the temperature of the magnetisation; the increase of the residual quantity of magnetism after cooling, when the magnet is heated anew.

New System of Electric Light with an Independent Regulator.—M. E. Girouard.—This paper requires the accompanying illustrations.

Influence of Different Manurial Elements on the Growth of the Beet, and on its Proportion of Sugar.—M. H. Joulie.—Phosphoric acid increases the proportion of sugar. Potash has not this effect, but renders the roots more saline and of worse quality. Nitrate of soda is favourable to the gross yield without injuring the quality. Assimilable nitrogen is favourable to the yield, without injury to the quality, if applied in moderate doses, beyond which it is hurtful both to quality and weight. Nitrogen in nitrates is preferable to nitrogen in ammonia.

Bulletin de la Societe Chimique de Paris. No. 2, January 20, 1876.

Determination of the Alkaline Metals in Silicates and Substances not Attacked by Acids by means of Hydrate of Baryta.—M. A. Terreil.—The author attacks silicates with perfectly pure hydrate of baryta, fused and pulverised, using 7 to 8 parts to 1 of the silicate. The operation is performed in a silver crucible at 350°, the temperature being raised a little when the fused mass has again solidified, but so as not to reach dull redness. The mass, after cooling, is boiled in pure water in the crucible, and the filtrate is treated with a current of well washed carbonic acid, raised to a boil, and filtered. The alkalies will be found in the filtrate.

Part Played by Acids in Dyeing with the Colouring Matters of Madder and their Artificial Substitutes.—M. A. Rosenstiehl.—Already noticed.

Theory of the Production of Aniline-Black by means of the Salts of Vanadium.—M. A. Guyard (Hugo Tamm).—See page 70.

Separation of Arsenic from Sulphuric Acid by means of Hyposulphite of Soda.—M. Thorn.—This method has been adopted in several manufactories of sulphuric acid. The arsenic is chiefly present in the chamber acid in the state of arsenious acid, but by the action of hyposulphite of sodium it is transformed into sulphide of arsenic and sulphate of soda. The manner of operating is as follows:—The chamber acid at 50° B. is heated in a leaden vessel to 70° or 80°, with the addition of the necessary amount of hyposulphite (according to the arsenic present), either dissolved in water or as a powder. The whole is then well stirred. Sulphide of arsenic separates out, and collects in flakes on the surface of the acid, which is then drawn off from below. Only a very slight escape of sulphurous acid occurs if the operation is

properly conducted. The purified acid contains 0·30 to 0·40 per cent of sulphate of soda, which, for most purposes, is not prejudicial. The quantity of arsenic in the raw acid at 50° B. varies from 0·098 to 0·004 per cent.—*Dingler's Journal.*

On the Same Subject.—R. Wagner.—To obviate the presence of sulphate of soda in the sulphuric acid when purified, the author proposes the use of the hyposulphite of barium, prepared by the reaction of hyposulphite of sodium and chloride of barium. A deposit of sulphide of arsenic and sulphate of baryta is formed, and the purified acid is run off.

Phosphuretted Copper.—M. Schwartz.—The author lines the crucible to be employed with a paste made of 14 parts silica, 18 parts bone-ash, 4 parts charcoal powder, 4 parts soda, and 4 parts powdered glass, mixed with a solution of gum. The crucible is dried, the copper introduced and covered with the same mixture, and the lid luted on. The whole is then raised to a bright red heat. The copper is afterwards found to contain 3·25 per cent of phosphorus. In preparing phosphor-bronze the phosphide of copper is melted with such proportions of tin and copper that the whole may contain 0·5 per cent of phosphorus.

Use of Xanthate of Potash as a Remedy for the Phylloxera.—T. Zœller and A. Grete.—The authors propose to use the xanthate in place of the sulpho-carbonate.

Gazzetta Chimica Italiana, Anno v., 1875, Fasc. vii., viii.

Chemistry at the Twelfth Congress of Italian Men of Science, held at Palermo.—The meetings of the Chemical Section, six in number, were held in the Chemical Lecture-Hall of the University, on the 30th of August, and on the 1st, 3rd, 4th, 5th, and 6th of September. The introductory discourse was delivered by Prof. Cannizaro, and is not adapted for abstraction.

Composition of Certain Italian Minerals and Rocks.—Prof. Alf. Cossa.—The author, in this first portion of his memoir, describes the analytical methods employed. For opening up the silicates insoluble in the ordinary acids he has quite abandoned the use of solutions of hydrofluoric acid. For the determination of all the constituents, except the alkalies, he has had recourse to fusion with mixed carbonates of potash and soda. For the alkalies he has followed, with some modifications, the method proposed by Ste.-Claire Deville.

New Method of Formation of Benzylated Phenol.—E. Paterno and M. Filetti.—The authors mix 40 grms. benzoic alcohol with 36 grms. of crystalline phenic acid, dilute the mixture with 140 grms. of glacial acetic acid, and then cool with water whilst gradually adding about 1½ volumes of a mixture of equal volumes of commercial sulphuric acid and acetic acid.

On Two Isomeric Amido-cuminic Acids.—E. Paterno and M. Filetti.—The authors have obtained the two isomers in question by the reduction of nitro-cuminic acid prepared in the ordinary manner. They suggest the possible existence of two isomeric nitro-cuminic acids.

Action of Light upon Nitro-cuminic Acid.—E. Paterno and M. Filetti.—Nitro-cuminic acid is profoundly affected by the influence of light. Whether it is exposed to the direct solar rays or to diffused light, it takes a red colour. The authors have traced the formation of a red substance of a decidedly acid character, and having an elementary composition very near that of the original acid.

Benzylic Derivatives of Urea and Sulph-urea.—E. Paterno and P. Spica.—The method employed by the authors has been to cause a salt of dibenzylamin to react upon the cyanate and sulphocyanate of potassium. In this manner they have prepared mono-benzyl-urea and mono-benzyl-sulphurea.

Cyanide of Acetyl.—M. Filetti.—The author having heated, for four to five hours, equivalent proportions of chloride of acetyl and dry cyanide of silver, and then submitted the result to fractional distillation, obtained three liquids. The first contained chloride of acetyl; the second portion, containing the cyanide, boiled at 93°, and the third went over about 200°.

On Paratoluylic Amide.—P. Spica.—This substance forms fine prismatic crystals, perfectly colourless, and slightly soluble in cold water, chloroform, and benzin, but freely soluble in boiling water, alcohol, and ether.

Action of Chloride of Cyanogen, Gaseous and Solid, upon Cuminic Alcohol.—P. Spica.—The author by the action of the gaseous chloride obtains cumilic carbammate, containing 68·33 per cent of carbon and 7·85 of hydrogen.

New Reagent for Morphia.—Prof. E. Selmi.—The author takes glacial acetic acid, stirs it up for fifteen minutes with minium in fine powder, filters, and places a drop upon a plate of glass laid upon white paper. Upon this drop are put 2 or 3 drops of an aqueous solution of acetate of morphia, drying each time at a very gentle heat, so as to have at last a spot formed of the dry acetate of the alkaloid. From the first instant there appears a slight yellowness, which goes on increasing as the acetic acid evaporates, passing into a bright yellow, an orange, and a dark yellow. If left to spontaneous evaporation the yellow gives place to a violet, which grows paler, and finishes by taking the colour of lees of wine.

On an Alkaloid found in the Brain, the Liver, and in the Green Heads of Wild Poppies.—Prof. Selmi.—A preliminary notice.

On a New Method of Preparing Diphenyl.—Dr. A. Cristomanos.—Not suitable for abstraction.

Presence of the Peroxide of Hydrogen in the Juices of Plants.—G. Bellucci.—The author's experiments, undertaken to verify the statement of Clermont (*Comptes Rendus*, 1875, Issue., p. 1591), have led to a negative result.

Supposed Transformation of Cellulose into Gum.—M. Mercadante.—The author holds that this alleged metamorphosis is not admissible.

On the Reagent of Barreswill, Fehling, and Trommer, for the Determination of Glucose.—G. Missaghi. An examination of the modifications of this test recently proposed by Lagrange and Boivin.

Arrangement of a Filter for the Separation of Crystalline Substances Entangled in Large Amounts of Extractive Matter.—G. Missaghi.—The author selects a funnel with a long neck, and puts into it a layer of pieces of porcelain large enough not to enter into the neck; upon this comes a layer of gradually smaller and smaller pieces, so as to sustain a disc of filter-paper, with its edges adhering to the sides of the funnel. Over this is placed fine pure silica, filling the hollow made by the paper. Over this comes another disc of paper. The funnel is then connected with an aspirator.

Persistence of the Germinative Power in Seeds Steeped in Water and Tumified when kept in an Atmosphere of Carbonic Acid constantly Saturated with Moisture.—G. Missaghi.—A few grains of wheat were first allowed to swell in distilled water, and were then placed in an atmosphere of carbonic acid. Other grains, rubbed first when dry, and washed with distilled water, were then allowed to swell in the same apparatus, in which was a stratum of water saturated with carbonic acid. The seeds were then planted in separate pots filled with the best vegetable mould. Those of the first lot all putrefied, whilst the second germinated and grew.

Evolution of Hydrogen during the Vegetation of Mould.—G. Missaghi.—The author was unable to detect any free hydrogen in the atmosphere in which the mould was growing.

Certain Processes for Freezing Iodide of Potassium from Iodate.—G. Pellagri.—The author has tried successfully the action of an electric current.

Preparation of Bicarbonate of Potassa.—Dr. L. Pesci.—The author passes a current of carbonic acid into a solution of pure potassa in alcohol (absolute, or of 80 per cent), so that not all the carbonate may be transformed into bicarbonate. From the filtrate pure bicarbonate is deposited.

On Certain Reactions of Chloral.—D. Amato.—Not suited for abstraction.

On Nitrostimol and Certain of its Derivatives.—R. Schieff.—Not adapted for abstraction.

On Indigotin in Animals, or the Purple of the Ancients.—A. and G. De Negri.—Already noticed.

New Spectroscopic Method for Discovering in Gaseous Mixtures and Liquids the Smallest Quantity of a Gaseous or Very Volatile Hydrocarbon.—A. and G. De Negri.—Into a Geissler tube is introduced a small quantity of a gaseous mixture, which ought not to contain oxygen, carbonic oxide, or carbonic acid, exposing it to a barometric pressure not greater than 20 m.m. If in the gas under examination a hydrocarbon is present, on causing it to be traversed by a spark from a Ruhmkorff's coil, a sky-blue light suddenly appears, which, if viewed with the spectroscope, presents the spectrum of carbon, and generally so brilliant as to mask totally the spectra of other gases present, not excepting nitrogen.

Production of Ozone by means of the Electrophoric Discharge.—G. Giannetta and A. Volta.

Reaction by means of which Sulphur destroys the Oidium of the Vine and on the Emission of Free Hydrogen from Plants.—E. Pollacci.—These two papers do not admit of abstraction.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

Improvements in the manufacture of black for painting or printing, which is also applicable to discolouring sugar, and for use as a disinfectant. D. C. Knab, Saint Denis, France. December 23, 1874.—No. 4421. Caustic lime, perfectly crushed and sifted, is intimately mixed with gas-tar or other body giving carbon by distillation in closed vessels. The proportions are from 30 to 50 parts of tar to 100 parts of lime. As dry caustic lime is difficult to crush, it is slacked with the least possible quantity of water, so as to obtain a well pulverised powder, which is thoroughly mixed hot with the tar. The intimate mixture thus formed is placed in a gas-retort, or in earthenware or iron pots, and heated to red-heat until gas ceases to be given off. The pots are then withdrawn and allowed to cool, and the cold matter extracted from the pots is emptied on a brick floor, and taking up the moisture of the air falls in powder as pure caustic lime. During carbonisation in the black pots the gases which ignite on removing the closed pots produce an immense smoke, which, being collected, by this means two blacks are obtained, one analogous to bone-black, the other similar to the black of ordinary smoke. The black thus produced is a rough or raw black, suitable for employment like powdered bone-black, such, for instance, as blacking and common black colours; and by treating this rough black with muriatic acid or any other lime solving acid the lime is completely removed, and perfectly pure and beautiful black is the result.

An improved method of and apparatus for ascertaining or proportioning and titrating the quantity of tannin in oak-bark and other tanning substances. W. E. Gedge, Wellington Street, Strand, Middlesex. (A communication from L. A. Beaudet, Paris.) December 23, 1874.—No. 4423. This process of proportioning the tannin consists in the precipitation obtained, and consequently in the volumes of the precipitates contained in guaged and graduated testers. The operator takes, say, 5 grms. of pulverised oak-bark, or 5 grms. of any other tanning material which it is desired to analyse; boils it in several waters, so as to extract all the tanning principle; then brings the volume of this solution to the measure of a half litre, either by reducing it or by adding the necessary volume of water; 30 grms. of this solution, reduced to a half litre, are then poured into a conical tester guaged according to this invention. The tester is then filled with clear water up to a volume of 125 grms., and the solution precipitated by means of neutral or ammoniacal salts, salts of lead, copper salt, salt of Titan, or organic alkalies, such as salts of "cinchonine," quinine, or strychnine, in the proportion of 15 grms. for the 125 grms. of liquid above mentioned. There is thus obtained the volume of precipitate which indicates exactly the quantity of tannin, which is the object sought, which quantity is engraved in centimetres on the conical test-glass. The tannin may also be proportioned or titrated by the combination of the weights, volumes, and graduations, whatever the form of the vessels employed.

Improvements in the purification of water. J. A. Wanklyn, Charlotte Street, Middlesex. December 23, 1874.—No. 4424. The object of my invention is to extend the application of the Clark process to those other waters to which it is not at present applicable, and this object I attain by the use of carbonate or bicarbonate of soda, or of other soluble carbonates or bicarbonates which will effect the decomposition of the salts of lime and magnesia, and yield carbonates or bicarbonates of lime or magnesia, to which the usual Clark process is then applicable. After having thus treated the water containing soluble salts of lime or of magnesia in other than or in conjunction with bicarbonate of lime, I then submit the same to the treatment of what is known as the Clark process. It will be evident that the softening process which I have described may be employed either as a preliminary process or in conjunction with the lime or Clark's process in order that the desired results may be simultaneously obtained. The amount of soluble carbonates or bicarbonates to be employed for effecting the softening of the water will, of course, depend upon the amount of the salts of lime and magnesia contained in the water in a form other than that of bicarbonate, and the amount of the carbonates or bicarbonates employed will be in equivalent proportions to those salts or compounds contained in the water to be treated.

Improvements in dyeing and printing, and in improved compounds for such purposes. J. S. Sellon, Hatton Garden, and R. Pinkney, Bread Street Hill, London. December 24, 1874.—No. 4433. This invention relates to improvements in dyeing and printing, and in improved compounds for such purposes; and consists in the employment of compounds of vanadium and of soluble salts or compounds of vanadium, for the purposes of dyeing and printing in conjunction with other dyeing and printing agents, such, for example, as the organic vegetable animal or artificially-produced dyeing or printing materials. In carrying out this invention the salts or compounds of vanadium are mixed with the dyeing and printing materials, and in such quantity as shall produce the desired result, so that the colour produced when the material to be dyed or printed shall be preserved and intensified, and that the dyeing or printing materials employed shall be economised.

Improvements in treating ores, minerals, and other bodies containing metals to obtain gold, silver, and other products therefrom, and in the apparatus employed therein. T. Clark, M.D., Wilmslow, Chester, and E. Smith, F.C.S., Torquay, Devon. December 26, 1874.—No. 4448. An improved method is described of treating metalliferous bodies or fluids with alkaline hyposulphite, preferably hyposulphite of soda, or with caustic or liquor ammonia, or salt containing free ammonia, or with a mixture of any alkaline hyposulphite with any of these ammoniacal compounds; the solution of silver, &c., obtained is then run into a tank properly prepared to induce galvanic action. A means is described of aiding such action by superheated steam: also of chloridising tin ore in a dry state, and a special arrangement of tanks suitable for such purposes is also described.

Improved process and apparatus for the treatment of oily and fatty matters, and of materials containing oily and fatty matters, and in the subsequent recovery or separation of the oil or fat or oily and fatty matters from the agent employed, and of the agent itself, and in drying the materials treated. G. W. Bentley, Kennington Park Road, Surrey. December 28, 1874.—No. 4452. Some or all of the following particulars, that is to say, drying by air passed over chloride of calcium, extraction of grease (whether oily or fatty) by carbon bisulphide or some hydrocarbon, or amyl alcohol, distillation for the recovery of the oil and fat and of the agent, washing or cleansing, and drying. Suitable arrangement of two cylinders or vessels one revolving one within the other.

Improved apparatus to be used in the manufacture or production of carbonate or bicarbonate of soda, and for other purposes. H. Müller, Dusseldorf, Rhenish Prussia. December 28, 1874.—No. 4458. The invention relates to apparatus for the manufacture of carbonate and bicarbonate of soda by the so-called ammonia process, the said apparatus being also applicable for use in other chemical processes in which it is required to bring fluids in intimate contact with gaseous matters.

Improvements in the manufacture of iron and steel. J. T. Kirkwood, Cheltenham, Gloucester. December 29, 1874.—No. 4463. These improvements consist in using and mixing peroxide of iron or any other oxide of iron with the iron or steel contained in any converter or other suitable vessel: and also at the same time, or at any more convenient period, the inventor introduces atmospheric air, steam, or other gases or vapours, mixed or unmixed with atmospheric air, which impinge upon the surface of the slag and molten metal for the purpose of purifying the same.

NOTES AND QUERIES.

*** Our Notes and Queries column was opened for the purpose of giving and obtaining information likely to be of use to our readers generally. We cannot undertake to let this column be the means of transmitting merely private information, or such trade notices as should legitimately come in the advertising columns.

Refining of Rape Oil.—Can any of your readers inform me of the best material for coating the iron tanks and pipes used in the refining of rape oil by means of sulphuric acid?—Rape Oil.

Dry Rot.—(Reply to "Dry Rot").—Dry rot is both prevented in new buildings and cured in old ones by filling up the space between the floor joists with "tank-waste" from alkali works. This can also be applied to the ends of beams resting in walls.—Geo. Lunge.

THE CHEMICAL NEWS.

VOL. XXXII. No. 848.

ON THE

LOSS OF COPPER THROUGH VOLATILISATION IN THE CORNISH COPPER ASSAY.

By JOSEPH ROSKELL, Widnes.

My attention has been drawn to an article in the CHEMICAL NEWS (vol. xxvi., p. 243), by Cornelius A. Mahoney, on the above subject, in which the writer attributes the whole loss to the use of salt (NaCl) in the process of assaying. I think there is no doubt but that it is the cause of a part of the loss, but in my opinion not the whole of it.

When calcic fluoride (CaF_2) is acted upon by sulphuric acid or an acid sulphate (SO_2HONaO or $NaHSO_4$), hydrofluoric acid (HF) is formed, and this again by reacting upon silica (SiO_2) produces volatile silicon fluoride (SiF_4), and if a borate ($B_4O_5NaO_2$) is present it produces volatile boric fluoride (BF_3). Now in the crucible we have when fusing for regulus the necessary ingredients for producing these reactions; thus we add fluor-spar and borax as fluxes, and the sulphur necessary to produce the acid or the sulphate is either present in the ore as a sulphide, or else is added to it in the form of sulphur; and I therefore think it probable that these reactions do take place while fusing, and so produce these volatile products, which would have the same tendency to carry off the copper as the salt would, and it is well known what a vast amount of fumes are given off during the fusion.

To ascertain if any of the copper was carried off or not during this fusion, I decided to make a few experiments upon different samples of ore and containing different percentages of copper, and consisting of sulphides and carbonates. The samples were all assayed by myself against two of the recognised assayers in Cornwall, and were selected for these experiments because their assays agreed either exactly with my own assay or did not differ by more than 1-8th per cent.

I knew that if no copper was carried off during the fusion for regulus that I ought to have the same quantity in the regulus and the slags that the ore itself contained; but if I obtained a less quantity, then some of it must have been carried off. In the fusion for regulus I used no salt, so that any loss could not be attributed to its use; the weight of ore used in each experiment was for those above 12 per cent, 1000 grs., and for those under 12 per cent, 2000 grs., which was fused in crucibles containing 500 grs. in each. The regulus was weighed and a portion taken and assayed by the usual "dry" method, and another portion used to ascertain the produce by "wet" assay; two assays were made by each method from each sample of regulus, the weight of which corresponded to 200 grs. of the rich ores and 400 grs. of the poor ores. The slags were also weighed and tested, and the quantity of copper found in them added to the percentage. The "wet" assay was performed by the "cyanide" test so diluted that each degree of the burette was equal to 0·05 gr. of copper. The sample of regulus, after dissolving, was made up to 1000 grain measures, from which I took various quantities for each test. The ore itself was treated similarly, and its percentage ascertained. The ammonia used was measured and the same quantity was used for standardising as was used in each test.

I also assayed three of the poor samples without using any salt whatever in any part of the process, the result being in one case the same, and in the other two slightly below the percentage of the ordinary assays.

It will be seen by the table here given that in no case does the quantity of copper found in the regulus along with what is contained in the slags, correspond to the quantity found in the ore, while at the same time it is more than what is given by the finished "dry" assay. This I think is sufficient proof that some portion of the copper is lost without the use of any salt whatever, and must I think be put down to the volatile products formed in the fusion for regulus.

I am also inclined to think that some of the copper is also lost during the calcining by being carried off mechanically by the sulphur. This I intend to experiment upon again, and will let you know with what results.

No. of Sample.	Quality.	Ore, Dry Assay.	Ore, Wet Assay.	Difference.	Regulus, Wet Assay.
1.	Purple ore	49·875	50·750	0·875	50·300
2.	{Sulphide / yellow}	30·125	31·000	0·875	30·560
3.	,,	17·825	18·500	0·675	18·340
4.	,,	16·214	17·000	0·786	16·855
5.	,,	9·275	9·750	0·475	9·425
6.	,,	11·500	12·000	0·500	11·746
7.	,,	11·275	11·725	0·450	11·500
8.	,,	7·875	8·452	0·577	8·000
9.	,,	8·180	9·000	0·820	8·410
10.	Carbonate	27·250	27·750	0·500	27·400
11.	,,	19·510	20·250	0·740	19·833
12.	,,	27·500	28·750	1·250	27·725

REPORT

ON THE

DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 70.)

SIEBE'S machine appeared at the London Exhibition of 1862. Schmidt† published an illustrated description of the machine exhibited, remarking that another machine in the possession of the patentee worked by a 24 horse-power engine produced 5 tons of ice in 24 hours, which, under the most favourable circumstances, may be regarded as 4 kilos. ice per kilo. coal consumed. In this machine the evaporator is like a boiler with horizontal tubes. It is stated that‡ the cost of producing the ice amounted to one and a half marks (about 1s. 6d.) per cwt. A further account of Siebe's machine is found in *Engineering* for 1868, No. 483.||

According to this journal such a machine was in use in Truman and Hanbury's brewery in London, yielding 6 tons of ice per twenty-four hours, and worked by a high-pressure engine of 15 horse-power. 1 cwt. of coal produced 4½ cwts. of ice. The solution of salt is said to have a temperature of −8° to −12°. In 1870 appeared a final description of Siebe's machine.§ A new and very compact little apparatus is mentioned driven by a 1 horse-power engine consuming 5 to 6 lbs. of coal per hour, and yielding 12·5 to 15 kilos. of ice hourly, or 5 kilos. of ice to 1 of coal.

No intelligence has been obtained concerning ether machines from other countries and by other makers. It has never, to our knowledge, been brought into use in Germany. At the Vienna Exhibition this principle was represented by one machine by Siebe and Gorman, of London.

Ether is a liquid which, under ordinary pressure, boils at 35° C.; under other circumstances the relation between temperature and pressure is as follows:—

Temperature	−20°	0°	+20°	40°	90°	120° C.
Pressure	0·09	0·24	0·6	1·2	5	10 atmos.

* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzehends."

† Schmidt, *Dingl. Pol. Journ.*, clxviii., 434.

‡ *Dingl. Pol. Journ.*, clxvii., 397.

|| *Dingl. Pol. Journ.*, cxci., 189.

§ *Prakt. Mech. J.*, 1870, 251.

If allowed to evaporate much below the freezing-point of water the tension of the vapour is very low, perhaps only one-tenth of an atmosphere. Hence the external air exerts a great and permanent pressure upon the evaporator, and upon the air-pump which draws out the vapour. The joints and fastenings must therefore be made with extreme care, lest a trace of air should enter, which would have the most pernicious influence on the working of the machine, and especially on the speed of evaporation. On compressing the vapours the tension rises to several atmospheres, and a rise of temperature occurs amounting certainly to more than 60°. If cooled at this pressure the vapour re-condenses to a liquid. More accurate statements as to relative pressure and temperature of the vapour of ether cannot be found. The basis for the calculation of the theoretical duty of the machine is the same as that of the air-machine to be described below, for which the requisite data are furnished and to which we may refer. From the known magnitude of 90 heat-units (the latent heat of the vapour of ether), it is possible to calculate how much ether, theoretically, must be evaporated to yield a given weight of ice.

Substitution of Methylic Ether for Ethylic Ether.—Methylic ether is formed by the action of sulphuric acid upon methylic alcohol or wood-spirit, a homologue of the ordinary ether produced by the action of sulphuric acid upon spirits of wine, and distinguished by its far greater volatility. Methylic ether is gaseous at ordinary temperature and pressure, and can be condensed to a liquid only by great pressure or by cold. The liquid, at the pressure of one atmosphere, boils at −21°. Tellier, of Paris, has used this ether as an agent for the production of cold in his ice machine, which is constructed exactly like that of Siebe.*

(To be continued.)

ON ELECTROLYTIC ANILINE-BLACK.

By M. FR. GOPPELSRŒDER.

If a galvanic current, weak or strong, passes through an aqueous solution of the hydrochlorate, sulphate, or nitrate of aniline, whether cold or hot, dilute or concentrated, neutral or acid, there appears—in a longer or shorter time—a green deposit at the positive pole, which passes by way of violet and bluish violet to a deep indigo-blue. The tartrate, oxalate, and acetate of aniline yield merely a brown deposit, accompanied by a little green. If we reverse the poles decolouration appears at that which was previously positive, and the same colours are reproduced at the pole which had been negative.

The reaction is very sensitive, for 1 m.grm. of hydrochlorate of aniline, dissolved in 60 c.c. of water, gives in a few hours a green deposit at the positive pole. With a solution of 1 m.grm. of the same salt in 30 c.c. of water, there appears not merely the green, but also the blue and the violet reaction. With 2·5 m.grms. of hydrochlorate of aniline in 30 c.c. of liquid there was produced, in the course of two hours, a violet-blue deposit partially of a greenish grey; an hour later a brown colouration of the liquid, and still later a very distinct green reaction.

The liquid into which the positive electrode dips exhibits very different colours—sometimes yellow, orange-red, or violet. When the salt of aniline is entirely decomposed the liquid becomes colourless.

The cotton, filter-paper, wool, or silk, employed to conduct the current from one vessel to another, is coated with the same colour as the electrode, and is even dyed a salmon-brown, a green, gray, or red, the liquid containing different colouring matters, which are separated by the capillarity of the fibres. In place of these conductors amianthus may be employed.

The negative electrode is merely covered with a slight black shade, and there is produced at most a light yellowish brown deposit at the bottom of the vessel. The liquid at this pole is coloured a yellow or reddish brown, the conductors being dyed analogous shades.

The green deposit obtained in the first place at the positive pole is a body unalterable by ozone when dry, but in ammonia it turns a greenish blue, and subsequently blue. After the ammonia has evaporated it becomes again blue. The green deposit from the positive pole, when moist, is affected by ozone, and becomes a deep violet-blue if heated with a solution of bichromate of potassium, but if treated with a strong acid turns green again. As for the deep indigo-blue deposit, it is a mixture of several colouring matters, among which is aniline-black, from which the other colours may be separated by ordinary solvents, such as water, alcohol, ether, benzol, acids, and dilute alkalies. The quality and quantity of these colouring matters accompanying the black depend on the nature and concentration of the liquid, the strength of the battery, the temperature, and other accessory circumstances.

The deposit at the positive pole after purification is a fine crystalline black, of metallic lustre, not capable of sublimation; insoluble in water, the alcohols, benzol and its homologues; unalterable by weak acids, even at the point of ebullition, but turning green if boiled with concentrated acetic acid. It resists the action of reducing and oxidising agents; it is unaffected by ozone, either in the dry or the wet state,—by electrolytic oxygen and hydrogen, by nascent hydrogen, and by chlorine-water. It is not soluble in alkaline solutions, but is in part modified, since alcohol subsequently extracts a blue colouring matter, which becomes green with ammonia and yellow with acids.

The electrolytic black heated with alcohol, under pressure, colours it a deep violet, which becomes more beautiful if treated with alkalies, and is unalterable in dilute acids. The electrolytic black dissolves in sulphuric acid. The solution is violet, blue-green, or brown, according as the sulphuric acid reacts more or less energetically upon the black. The violet, blue, and green sulphuric solutions, if poured into water, give a green precipitate. The filtrate is colourless or reddish, and in the latter case contains a red substance the alcoholic solution of which, mixed with ammonia, is of a fine rose-colour, having a beautiful fluorescence like that of naphthalin-rose.

The green precipitate obtained from the sulphuric solution of the black poured into water is insoluble in ordinary solvents, but it may be suspended in water so finely that it appears to be dissolved. This green dissolves in hot sulphuric acid with a dirty violet colour, and is re-precipitated by water. If submitted to prolonged heating with sulphuric acid the water takes a rose-colour, and with ammonia becomes of a bluish colour with a yellow fluorescence. With caustic potassa it becomes bluish, and the filtrate is red. Ammonia renders the green violet, and even black, but acetic acid converts it to a green again. After the addition of ammonia, or of a fixed alkali, the aqueous liquid in which the green is suspended becomes of an intense blue, but the colouring matter is still merely suspended, a minimum portion only dissolving, for the filtrate has a faint violet-blue colour. Nascent hydrogen decolourises it by degrees.

If heated to redness in a combustion-tube, with a mixture of lime and soda, electrolytic black disengages white vapours, which have the odour of aniline, and which turn turmeric brown. If a stronger heat is applied ammonia is obtained. If the layer of soda-lime is not very long a violet sublimate is obtained at the same time, soluble in alcohol, with a violet-blue colour by transmitted daylight, but violet-red in artificial light. The liquid is rendered green by hydrochloric acid, and the blue colour is restored by alkalies. The presence of nitrogen in the electrolytic black has also been demonstrated by the potassium reaction.

An optical examination of the electrolytic black has

* *Engineering*, 1871, 179. *Dingl. Pol. Journ.*, ccii., 191. *Pol. Centralbl.*, 1872, 38.

shown that it is more black than the other aniline-blacks with which it has been compared.

The author announces his intention of shortly laying before the Academy the results of an elementary analysis of these bodies most carefully purified.—*Comptes Rendus.*

ON THE

RELATIONS OF CHEMISTRY TO PHYSIOLOGY AND PATHOLOGY, WITH SPECIAL REFERENCE TO THE BRAIN.*

By CHARLES T. KINGZETT, F.C.S. London and Berlin, &c.

THE vast advances that physiology has made in recent times are in no small measure due to the influences exerted by the discoveries and writings of Justus Liebig. He was among the first to expose the non-scientific method of enquiry employed by many physiologists of his day, and he perhaps, more than any other, impressed inquirers with the importance of tracing back effects to causes. Thus he has shown (Liebig's "Animal Chemistry," third edition) how little is conveyed by stating the effects of the nervous system as due to a nervous force, or by calling a body which exerts a cooling action on the system an astringent. Such notions he demonstrated to have no more worth than the old notions of Lemery, that the particles of an acid had the form of spear heads with barbs, while those of the alkalies were porous like sponge.

The processes of organic nature are chemical processes, and can be discovered only by chemical methods, aided by a logical interpretation of facts. Even Liebig, in the preface to his work already referred to, acknowledges "how greatly he was indebted to the study of Mills's 'System of Logic,'" and states, further, "he can claim no other merit than that of having applied to some special cases, and carried out further than had been previously done, those principles of research in natural science which have been laid down by that distinguished philosopher."

Thus, then, we see that the relations of chemistry to physiology are clear and well defined, and may be expressed as the investigation of those chemical processes which are continually occurring in the human economy, and by the performance of which alone man can live in health. Obviously, therefore, chemistry in this aspect must commence with the study of the constitution of the various tissues, organs, and juices of the body: for without such knowledge we cannot study the processes in which they participate, no more than we could express in unintelligible language the action of hydrochloric acid upon chalk without having previously ascertained the composition of these substances. Having once attained such a position we may view the results in the light of "normal chemical standards."†

In the same way the investigation of pathological processes must follow after the chemical standards of health have been determined, for by pathology we mean the doctrine of the causes and nature of disease, the very idea of which implies that the ordinary vital or chemical processes of life are deflected from the normal course obtaining in health. The *method* of investigation, however, is the same, and the results may be viewed as the measure of the "morbid declensions" from the ordinary standards.

It would be vain on my part to attempt to review, in the space of one hour, all the relations of chemistry to physiology and pathology, and I have thought it best to treat only of those relations which regard the most important organ of our bodies—the Brain. In doing this I shall chiefly concern myself with the recently published researches of Dr. Thudichum, which, again to quote from the "Report of the Medical Officer of the Privy Council" (New Series, vol. iii., p. 9), show such "very remarkable evidences of success."

In the choice of my subject I have been guided chiefly by the consideration that I am well acquainted with this work, and in fact, as professional assistant to Dr. Thudichum, have been associated with him in the work itself.

The object of these researches was to unfold the chemical constitution of the brain, in order that in time to come it may be in our power "to guide or correct" those processes in disease, through the normal operation of which the brain performs its functions in health.

"It is confidently believed that its entirety has been explored in such a manner that fundamental truths cannot have escaped observation, and that what remains to be done is essentially of the character of detail, which however vast by multiplicity it may become will not alter the broad outline (to) which this investigation has led" ("Report," p. 203).

Those who may desire to study more in detail this subject I would refer to the published research, which they will find in the "Blue Book" from which I have quoted. For such a large enquiry recourse must be had to the brains of oxen, although I should state that the examination has also been conducted upon normal brains from healthy human subjects.

The brain of an ox weighs, on the average, 356 grms., or from 12 to 13 ounces; and in the research of which I am treating more than 2000 such brains have been employed.

I will first review the method of procedure in obtaining from brains the principles which I shall presently describe.

The brains are first carefully skinned, and freed by means of forceps from the arachnoid and pia-mater, after which they are cleansed from clot and blood by a temporary submersion in water, which has next to be removed by means of strong alcohol (of 85 per cent). This operation, which has to be repeated several times, dehydrates the brain matter, and eventually furnishes a watery solution, which—when freed from albumen, &c., by boiling and concentration—is found to contain, in part, the *water extracts of the brain.*

When the brains are well hardened in the way described, they are passed through a mincing machine, and the pulp so resulting is then made to pass as a paste with alcohol through a fine hair sieve.

The product is now ready for those operations which are intended to extract from it its chemical principles. It is therefore extracted now with alcohol of 85 per cent at a temperature of about 50° C., and filtered through cloths. By repeating this extraction five or six times there is finally left an *albuminous insoluble residue*, which forms next to water the body of greatest percentage in the brain.

The alcoholic extracts are united, and on cooling deposit a white crystalline and granular precipitate, to which we have given the name of *white matter.* After filtration from this, the extracts are concentrated by distillation, and the concentrated liquor allowed to cool, whereby is deposited a semi-solid viscous mass, which we have designated *buttery matter.* From this the mother-liquor is freed by filtration, after which it is entirely freed from alcohol by distillation, and is then still further concentrated by evaporation in open dishes. During this operation oily drops and lumps form; but these, when cold, become semi-solid and flaky, and can be isolated by filtration in the hot. This matter, which has for the most part the same composition as buttery matter, we shall consider under that heading.

The filtrate from the "last oily" (so-called) is concentrated to a thin syrup, and constitutes *water extracts of brain matter*, containing in solution the salts, extractives, and soluble immediate principles.

There are several methods of extracting from white matter and buttery matter the principles of which they are composed; but here I think it best to confine myself to one method, and one which is the most workable in practice; and as white matter and buttery matter are

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* A Lecture delivered before the Liverpool Chemists' Association, February 17, 1876.

† "Reports of the Medical Officer of the Privy Council, &c.," New Series, No. iii., p. 8.

identical, except as regards the *relative* amounts of the various constituents, the one process is applicable to both. White matter consists principally of bodies belonging to the group of cerebrins, with cholesterin, kephalins, myelins, and lecithins: so also does buttery matter, but it contains less of the cerebrins. To isolate these various principles white matter and buttery matter undergo extraction with ether, which furnishes a red-coloured solution having a strong fluorescence, and leaves the mass of cerebrins behind as a snow-white pulverulent whole, which can be afterwards differentiated into the several varieties composing it by suitable treatment.

The ether extracts contain kephalin, to which body the fluorescence is due, cholesterin, lecithin, and some myelin. They are concentrated, and on cooling deposit much of the cholesterin in white, pearly, crystalline plates, from which the solution is separated by filtration, after which it is treated with an equal volume of absolute alcohol, which precipitates the kephalin as a reddish brown viscid mass. This kephalin can be purified by re-solution in ether, and re-precipitation by alcohol; but to obtain it in a perfectly pure state it has to undergo a special treatment, viz., solution in water, and re-precipitation therefrom by hydrochloric acid, &c.

The mother-liquor from which the kephalin has been precipitated is free from the excess of ether by distillation, and yields, on cooling, another deposit of cholesterin, after separation from which it is thoroughly precipitated by a solution of chloride of cadmium in alcohol of 85 per cent. This treatment yields a precipitate consisting of the cadmic chloride salts of kephalin, lecithin, and myelin, and a mother-liquor which is concentrated nearly to dryness, yielding a further vast mass of cholesterin.

It may be at once stated that cholesterin may be readily purified by re-crystallisation from alcohol. Sometimes, however, it is necessary to add potash in this operation to free it from certain bodies of a fatty nature, and charcoal to take out certain colouring matters.

The cadmic chloride precipitate above described is split up into its component parts as follows:—It is first extracted with anhydrous ether, which dissolves the kephalin compound, but leaves the salts of lecithin and myelin as a white pulverulent mass. From these products the immediate pure principles can be respectively isolated only by long and tedious processes.

In addition to the substances I have enumerated there are present in the brain, and are obtained from "white matter," "buttery matter," &c., certain neutral lipoid matters, the history of which has not been yet thoroughly studied. In the extraction of "white matter" by ether there is left, as I have stated, a snow white pulverulent mass of cerebrins, which contains also some myelin.

The myelins differ from the cerebrins in being phosphorised, and have to be separated from the latter by special methods. The so-called cerebrins consist of at least three bodies, namely, true cerebrin, phrenosin, and kerasin, and they can be respectively isolated by fractional precipitation on cooling from a hot alcoholic solution, supplemented by the application of more involved processes.

We have yet to treat of the water extracts of brain-matter. They contain hypoxanthin, creatin, lactic and perhaps other extractive acids, phosphates, sulphates, and chlorides of the metals potassium and sodium. When the brain-matter is derived from the ox, also inosite or so-called muscle sugar, is present in quantity. In addition to these matters, there are also invariably present in the brain, calcium, magnesium, iron, copper, manganese, &c., &c.,

I have thus sketched briefly the mode of isolating from brain-matter the various principles it contains, but only one form of one process has been enunciated.

TABLE SHOWING CONSTITUENTS OF THE BRAIN.

Group of Sulphurised Principles.

Albumen .. .. $C_{72}H_{112}N_{18}SO_{22}$

Group of Phosphorised Principles.

Sub-Group of Kephalins.

Kephalin .. .. $C_{42}H_{79}N\ PO_{13}$
Kephaloidin .. .. $C_{42}H_{79}N\ PO_{13}$
Oxy-kephalin .. .. .. $C_{42}H_{79}N\ PO_{14}$
Peroxy-kephalin .. .. .. $C_{42}H_{79}N\ PO_{15}$
Amido-kephalin .. .. .. $C_{42}H_{89}N_2PO_{13}$

Giving compounds with $PtCl_4$; $CdCl_2$; Pb; acids, bases, and salts.

Sub-Group of Myelins.

Myelin .. .. $C_{40}H_{85}N\ PO_8$
Oxy-myelin .. .. $C_{40}H_{75}N\ PO_{10}$
Amido-myelin .. .. .. $C_{40}H_{82}N_2PO_{10}$

Compounds as with kephalin.

Sub-Group of Lecithins.

Lecithin .. .. $C_{42}H_{83}N\ PO_9$

Compounds as kephalin.

Group of Nitrogenised Principles.

Cerebrin .. .. $C_{34}H_{68}N_2O_8$
Stearoconote .. .. $C_{34}H_{68}N_2O_8$
Phrenosin .. .. $C_{34}H_{67}N\ O_8$
Kerasin .. .. $C_{46}H_{91}N\ O_9$
Extractive and secretory acids.
Uric acids and congeners.
New acids.
Extractive alkaloids (several new ones).
Urea and amido-acids.

Group of Oxygenated Principles.

Cholesterin .. .. $C_{26}H_{44}O$
Inosite .. .. $C_6H_{12}O_6$
Lactic acid, &c.
Fats and fatty acids.

Group of Inorganic Principles.

H_2SO_4; HCl; P_2O_5; CO_2; H_2O; K; Na; NH_3; Ca; Mg; Cu; Fe; Mn.

The albuminous matters from the brain offer no specific difference from similar matter derived from other parts of the body, and exist mainly in the form insoluble in water.

The kephalins are all soluble in ether to a red colour, and possess a great affinity for oxygen, and also exhibit a wonderful power of combination, which is well explained by the constitution of the bodies. They contain their phosphorus in the form of glycero-phosphoric acid, which they yield along with neurine when split up by boiling with baryta water. The first member of this sub-group, viz., kephalin, $C_{42}H_{79}NPO_{13}$, has been especially well studied—so well, indeed, that of its individuality there is no more doubt than of the individuality of each of ourselves. It is the more interesting seeing it forms one of the bodies discovered in brain-matter for the first time by Thudichum.

The myelins are white and are not liable to atmospheric oxidation. They are not to be confounded (from their formulæ) with lecithin, which in the form described by Strecker (as obtained from eggs) is very unlike the myelins. They combine with lead, and from the lead compounds can be obtained the free principles in a purified condition by decomposition with sulphuretted hydrogen in hot alcohol, from which solution on cooling they are deposited in forms easily recognisable under the microscope.

In this lecture the name of lecithin has been repeatedly used as significant of a certain body present in and obtainable from brain-matter. It has been obtained mainly in combination with platinic chloride as hydrochloride, but this salt proves so unstable as to defy in great measure those attempts which have been made to elucidate its nature. But it has proved at least to possess characters different in some respects from those attributed to the lecithin described by Strecker and Gobley, although it appears to yield similar products of decomposition. My personal belief is that the lecithin of Strecker does *not* exist in brain-matter: meanwhile it may be allowed that

much more work will have to be done in this direction before very absolute statements can be made regarding this really marvellous substance.

Cerebrin, stearoconote, phrenosin, and kerasin, are all well characterised substances, and have been deeply studied. The first two are isomeric, stearoconote being formed from cerebrin, when the latter is heated in alcohol, at a greater speed than it can be dissolved, when it fuses and becomes insoluble. But the product is readily soluble in benzene, while cerebrin is absolutely insoluble in cold benzene; from the benzene solution the stearoconote is precipitated by alcohol.

Cerebrin seems to be the di-amidated form of a fatty acid, whilst phrenosin appears to constitute the mono-amidated form.

Kerasin has a microscopical character extremely easy to recognise, and of such form as to readily enable one to discover the presence of foreign matters.

These four substances are especially distinguished by their solubility in hot alcohol, and by the purple colour they give with sulphuric acid and sugar, a reaction similar to Pettenkofer's test for bile. This reaction I will now illustrate.

Inosite is a sort of sugar, and so far we have not specially sought for it in human brain-matter, although it is probably present, while in the brain of the ox it exists in very decided amount.

Of the other bodies to which we have alluded, as occurring in the brain, I shall only dwell on the presence of copper and manganese, because it has been represented to me that by some scientific men this statement has been regarded with doubt. We have worked up several thousand brains, and whenever we have searched for them we have always found them, equally when the brains were those of oxen or from human beings. In the case of copper we have reduced it to the metallic state, from a suitable solution, by an electric current, and before you there is a solution of copper (from one and a half human brains) in which we will now demonstrate its presence.

Moreover, the presence of copper in the brain is after all not so remarkable, for who does not know that Church discovered copper in the colouring-matter of the feathers (wing) of a bird, and recently M. Bergeron and L. L. Hôte (*Comptes Rendus*, lxxx., 268) have published experiments which they say have demonstrated the presence of copper in the kidneys and livers of fourteen human bodies.

But these experiments of Bergeron and Hôte were, we may say, unnecessary, for they simply amount to repetitions of those performed by Odling and Dupré many years ago. These chemists published a most interesting paper "On the Existence of Copper in Organic Tissues," in which they described whole series of experiments made upon comparatively large quantities of materials, in the years 1856 and 1857. These observers also refer to literature previously existing on the subject, which seems to indicate that so long ago as the latter end of the last century the presence of copper in organic tissues and products had attracted the attention of Margraff, Gahn, and Vauquelin.

Odling and Dupré detected copper in bread, flour, wheat, straw, liver, kidney, blood, flesh, eggs, cheese, &c., and in many instances estimated the amount by most reliable methods.

From one of the Tables published by these chemists we take the following determinations:—6925 grains of human liver furnished 0·013 grain of oxide of copper, while 6682 grains of sheep's liver furnished 0·281 grain of cupric oxide. 1830 grains of human kidney gave 0·015 grain of copper oxide, while human muscle and blood furnished traces. In short, they conclude that "the tissues, particularly of the liver and kidney, usually contain copper in very notable quantity," and that "the blood usually contains but very minute traces of copper." At the same time they thus express themselves:—"We are scarcely prepared to maintain that copper is a necessary and invariable constituent of living organisms."

There is one property common to many of the principles derivable from brain-matter, but particularly striking in the case of kephalin. When treated with water, kephalin swells and forms an emulsion, which ultimately becomes an imperfect turbid solution,—that is to say, it dissolves in a certain manner and in a certain measure, although it passes through many folds of Swedish filtering-paper in its turbid state. This substance, however, will not dialyse, and is therefore practically a colloid.

On the other hand, the bodies under the heading "Nitrogenous Group"—including cerebrin, phrenosin, and kerasin—behave somewhat differently towards water, in which they swell to gelatinous masses without afterwards dissolving. Thus a few grammes of cerebrin will swell to one hundred times (or more) its original volume. Here I have a little cerebrin in water, and on hastening the operation by the aid of heat, it swells like starch, and becomes a solid mass.

The phosphorised principles of which we have treated are possessed of acid, alkaline, and alkaloidal characters,—that is to say, they combine with alkalies, acids, and salts, with great avidity. In the several vessels before you there is contained a weak (1 per cent) solution of kephalin in water, and I will now add hydrochloric acid to the first, sulphate of copper to the second, sodium arsenite to the third, and platinic chloride to the fourth, when there is produced a precipitate in each case. This power of combination, however, can be overcome by water, so that if these precipitates were placed in water, on a dialyser, the respective combinants would again pass out, leaving behind pure kephalin. Although this affinity for water that kephalin exhibits is so strong, yet it is not so strong as that exhibited towards metallic oxides,—as lead, manganese, copper, and iron, which can be dissociated only by mineral acids.

I cannot do better here than quote two paragraphs from the summary Thudichum has given of his researches (see p. 199 of "Blue Book"):—"We have therefore here a diversity of affinities such as is not possessed by any other class of chemical compounds in nature at present known; and the exercise of these affinities being greatly influenced by the mass of reagent and the mass of water which may be present, the interchange of affinities may produce a perfectly incalculable number of states of the phosphorised, and consequently of brain-matter. This power of answering to any qualitative and quantitative chemical influence we may term the state of *labile equilibrium*; it foreshadows, on the chemical side, the remarkable properties which nerve-matter exhibits in regard of its vital functions.

"From this it also follows that nerve-matter (if only characterised by the phosphorised bodies) must yield obedience to every, even the slightest, external chemical influence which may reach it by way of the blood. It must take up metals, acids, salts, alkalies, and alkaloids presented by the blood; it can retain only oxides when the serum is again free from the combinants; a watery serum will wash the brain; a more watery one will make it swell and displace mechanically within physiological limits what it can; a still more watery one will make the brain dropsical, and produce all the conditions of mechanical pressure on the brain. All these processes are the necessary consequences of the affinities of the phosphorised substances, and, these being known, the phenomena could be predicted, if they were not sufficiently known as phenomena, though hitherto destitute of an explanation. Thus the so-called brain-fungus, the continued protrusion of brain-matter through apertures of the skull produced by mechanical injuries, may, in certain cases, find a physical explanation in simple excessive hydration of the phosphorised (and nitrogenised) principles, producing general inter-cranial pressure."

Bearing in mind what I have just read to you, in cases of poisoning by arsenic or mercury, we should expect to

find these bodies present in nerve-matter after death had resulted, in such instances, and there are records which bear out the truth of these observations. Indeed but recently D. Scolosuboff (*Bull. Soc. Chim.* [2], xxiv., 124), (*Journ. Chem. Soc.*, Ser. 2, xiv., 92) has published some experiments in which he administered doses of sodium arsenite to dogs, rabbits, and frogs, which show that *the poison concentrates principally in the nervous substance*, smaller quantities being found in the muscles, liver, and marrow.

These experiments following after the research of Thudichum only confirm, in the strongest possible way, the statement of Thudichum that "nerve-matter must take up metals, acids, salts, alkalies, and alkaloids, presented by the blood."

The phenomenon of the assimilation of arsenic had therefore been predicted, and D. Scolosuboff, by his experiments, have proved the truth of the prediction.

"These few examples," again to quote the words of Thudichum, "show that the acquisition of chemical statics leads almost necessarily and very easily to chemical dynamics of the brain; and these will, in their turn, furnish data for physiological and pathological conclusions. But these deductive arguments must be most sparingly and cautiously used until the statics are in a state of perfection and completeness. To argue too far from incomplete data would—seeing the history of biological chemistry during the last thirty years—be a deplorable error.

Liebig clearly showed how absolutely essential to plant growth was the minute amount of saline ingredients which plants leave in the form of ash when burnt, and it may now be accepted as an absolute truth, that, however minute the percentage proportion of each of these ingredients, they are individually as essential to the healthy plant-life as a supply of the most weighty constituents. Who can say, therefore, that the small amounts of inorganic ingredients of the brain are not equally necessary to its perfect development, and consequent functions, and are not present merely by *accident?* That this may be so is the more probable when we reflect that these saline matters are in combination with some of the principles; for unless special methods have been employed to rid cerebrin, phrenosin, kephalin, &c., from these matters, you will find them invariably present, no matter how many times you have re-crystallised from alcohol the first two named principles, or dissolved in ether the other, and re-precipitated it by alcohol!

It is perhaps less probable that the small amount of copper in the brain fulfils any useful function, and it is perhaps, therefore, present as accident only.

Again, in certain cases of softening of the brain, Dr. Thudichum has observed the presence of glycero-phosphoric and fatty acids in the free state. As these matters are *never normally* present, and as they constitute the decomposition products of some of the phosphorised principles, the idea is forced upon us that softening of the brain may be expressed chemically as the decomposition of one or more of the phosphorised principles into proximate nuclei. There are circumstances, as we have seen, which seem to corroborate the truth of this idea, but it may be absolutely untrue; in short, it is a thought, and not an unscientific one,—*i.e.*, a reasonable hypothesis.

Nerve-matter is made up of heterogeneous principles, arranged in such a manner as to vanish completely from appearance as chemical individuals. I will once more quote from Dr. Thudichum's publication ("Blue Book," p. 197). Dr. Thudichum there writes:—"The first striking fact which meets the enquirer is that nerve-matter contains abundance of water. This, in conjunction with the peculiar manner in which the water is contained, engenders a mobility of ultimate particles within certain limits of movement. It also gives penetrability by liquid diffusion, while excluding porosity and its capillary effects: by which means a ready nutrition by diffusion in one direction, and ready cleansing from the *effete* crystallisable products of life in another are ensured. Consequently the brain, as a whole, is essentially made up of colloid matter, and may be compared to a colloid septum, on the one side of which is arterial blood and cerebro-spinal fluid of the ventricles; on the other side, however, is cerebro-spinal fluid of the arachnoidal space and venous blood. It follows from this that the large amount of water present in the brain is not there, so to say, mechanically only, like water in a sponge, and capable of being pressed out mechanically, but is chemically combined as colloid hydration water, or, better, *water of colloidation*."

Dr. Thudichum has shown us that the healthy nutrition and functions of the brain depend upon its constitution, in which the character of the water present is most important; and I have pointed out to you that when brain-matter, after life, is placed in alcohol, it loses its water, its mobility of particles, and becomes more solid and firm. Is this sort of thing possible in life? Is it possible that, in cases of *delirium tremens*, so much alcohol has been consumed, as, by its diffusion through the brain in the form of blood, it has robbed nerve-matter of its mobile character, and consequently of its power to assimilate its food, and of its power to throw off the products of its life functions? These are questions which future research may entirely negative, but they constitute the bases of thoughts that arise in spite almost of ourselves, and again they constitute a reasonable hypothesis.

We have seen that the principles of which brain-matter is composed are, *en masse* (with the exception of the albuminous framework), soluble in warm alcohol, although the individual principles are not all soluble under these conditions. Now I have asked myself this question—Can a man consume so much alcohol in the form of stimulants, and retain enough in his blood in the unoxidised condition, to dissolve traces of matter from his brain? However horrible the thought may be, it is less horrible than the disease known as *delirium tremens*.

I have prepared a dilute solution of alcohol, and in it I have placed pieces of brain-matter, as derived from the ox, at a temperature of the blood, viz., 100° F. At this temperature it has been digesting some hours, and I will now filter it. On cooling, the filtrate throws down a white deposit of matter which the alcohol has dissolved,—a phenomenon which would seem to indicate some actual truth in Shakespeare's words "Oh, that men should put an enemy in their mouths to steal away their brains."

I will now submit to you a few instances which are calculated to exhibit, in regard to other vital functions, the relations of chemistry to physiology and pathology. In doing this I will choose the most familiar ones, namely, the function of the blood and its aëration, and the chemical processes of digestion.

The obvious function of the blood is to supply nourishment to, and carry away, the products of life from all parts of the body. Its constitution is extremely complex, and may vary—according to the nature of the food eaten and other causes—within certain limits; but, whatever its constitution, there are invariably present in healthy blood those small formations known as blood-corpuscles. The composition of these corpuscles depends upon the exercise of their own powers in relation to the surrounding serum of the blood, and is complicated. The most striking constituent is a body which has received the name of hemato-crystalline—a body which gives to the corpuscles their red colour. This body always contains 4-10ths per cent of iron, and its analyses lead to a formula for it of $C_{600}H_{960}N_{154}FeS_3O_{177}$, with an atomic weight (the greatest ever assigned to a principle) of 13,280. This formula may not be absolutely correct, but that the atomic weight is extremely high there can be no doubt, on account of the complicated function it fulfils in the body, and its probable constitution. That constitution can only be learnt by chemolysis,—that is, by splitting it up by suitable means into the proximate constituents, and these again into their more ultimate derivatives. Omitting other substances present in corpuscles, let us centre our

attention upon this hemato-crystalline, which is literally crystalline and of the rhombohedric system (see Thudichum's "Physiological Chemistry," p. 27). A solution of this body in water, when diluted sufficiently and examined spectroscopically, shows two bands of absorption, and "as the blood of all vertebrate animals, when viewed within the living blood-vessels, shows the same bands, we can assume that hemato-crystalline is present in it as such, and not formed by the process of preparing the crystals."—(Thudichum.) Now Stokes many years ago showed that these two bands were characteristic of arterial blood, for venous blood exhibits only one band; and that these properties are attached to the hemato-crystalline is proved by depriving it of its oxygen, when its spectrum furnishes the one absorption-band of venous blood; but by shaking again with oxygen the double-band spectrum is restored. With these data before us, let us endeavour to follow these properties of hemato-crystalline contained in blood-corpuscles into its life functions as displayed in the process of respiration.

That these corpuscles are the carriers of oxygen there can be little doubt; for the oxygen is not held in the blood like as carbonic acid exists in seltzer-water (that is, by solution), but it exists there in combination. In combination with what? We have seen what affinity hemato-crystalline has for oxygen, and it is reasonable to suppose that these bodies combine in a loose way; and in this form of combination the oxygen is carried by the blood circulation to the most distant and every part of the body, where it is given up to the tissues, and they in their turn return carbonic acid, water, urea, and other substances which are the products of the metamorphoses of the tissues to the blood. Now this carbonic acid of which we have just spoken is in part dissolved by the blood in a similar manner to that in which it exists in soda-water, but not entirely so, for to a great extent it is combined with alkaline bases, particularly sodium (Thudichum). Now Thudichum supposes that when the venous blood reaches the small breathing cells, the hemato-crystalline is oxidised partially into an acid, which he calls hematic acid, which—passing into the serum when the corpuscles arrive in the breathing-cells—decomposes the carbonates in the blood, setting free the carbonic acid, which, with water-vapour, escapes through the lung tissue into the respiratory passages.

We shall return to this subject when we come to speak of certain inductive processes of reason which J. Stuart Mill developed.

In the meantime let us pass on to consider certain changes of matter which occur in the stomach during digestion, a process which is mainly carried on through the agency of hydrochloric and lactic acids, which would seem to be formed by the decomposition of chloride and lactate of sodium in the glands of the stomach into free acids and caustic soda. But inasmuch as we nowhere meet with caustic soda in the animal economy, at first blush the above explanation would seem to be untrue; but it is easy to comprehend, under the ingenious theory of Dr. Thudichum (see his "Chemical Physiology," p. 16, and *Brit. and For. Med. Chir. Review*, October, 1861, p. 429; see also an enquiry by Pavy in *Phil. Trans.*, 1863), who supposes that before the soda enters the blood, and is carried away thereby, it has a function to perform, viz., "to protect the stomach against the corrosive action of its own secretion." Under certain abnormal conditions this corrosive action obtains, and gives rise to gastric ulcer and other pathological processes. In the blood the caustic soda soon becomes carbonate, and the presence of sodium in the bile may be proved by adding to it, say, hydrochloric acid, when at the end of the experiment sodic chloride will found, whereas it was not present before, but the sodium had been in combination with the binary acids —taurocholic and glykocholic—

$(C_{26}H_{45}NO_7S$ and $C_{26}H_{43}NO_6)$.

Bearing on the processes we have just been considering, allow me to quote a few words written by Mill in 1856 ("System of Logic," fourth edition, 1856), and which resulted from a consideration of Graham's researches, which demonstrate "that gases have a strong tendency to permeate animal membranes, and diffuse themselves through the spaces which such membranes enclose, notwithstanding the presence of other gases in those spaces." Mill then says (vol. i., p. 523):—"The exchange of oxygen and carbonic acid in the lungs is not prevented, but rather promoted, by the intervention of the membrane of the lungs and the coats of the blood-vessels between the blood and the air. It is necessary, however, that there should be a substance in the blood with which the oxygen of the air may immediately combine, otherwise, instead of passing into the blood, it would permeate the whole organism; and it is necessary that the carbonic acid as it is formed in the capillaries should also find a substance in the blood with which it can combine, otherwise it would leave the body at all points instead of being discharged through the lungs."

Now although respiration is to be considered as an act of secretion, yet you have seen how true were these prophecies of Mill. The oxygen of the air combines with the hemato-crystalline of the blood, and the carbonic acid evolved in the system combines with the soda (in some measure) present also in the blood. Liebig, however, disputed the presence of carbonates in the blood, on the evidence of some analyses he made of the ash of blood; but in all probability the phosphorus which we now know to be present in blood, both in the form of phosphates and as phosphorus in organic combination, had determined the substitution, and consequent expulsion, of the carbonic acid in Liebig's experiments.

"The physiologist, J. B. Willbrand, represented disease not badly as the battle of the chemical process with the organic process of life. The chemical process is victorious in death" (Thudichum, Cantor Lectures, *Journ. Soc. Arts*, vol. xxiv., p. 127); but it also makes sad ravages during life, and perhaps no disease illustrates in a better way the fact that in disease the chemical processes obtaining in health are deflected from their course than the disease designated "locomotor ataxia." In this disease the sense of pressure is either entirely or partially destroyed, and doubtless all have seen at times such cases in which the sufferers proceed step by step, and with that heavy tread which seems to indicate that they are not quite certain when their feet first touch the ground; and in truth this is so, although they are still susceptible to the senses of pain, heat, and cold. Well, in this disease, the spinal marrow undergoes what is termed "degeneration." There is, that is to say, a chemical process at work in the substance of the marrow which results in the production of a body, not yet well studied, but which is quite abnormal, and consists of matter like to cellulose and starch corpuscles. What is the nature of this body, and how has it been produced? These are the questions that chemistry must solve, and they can only be solved when it is in our power to make a quantitative analysis of nerve-matter. We are already far advanced on this particular road of research, and truths which now take the form of nebulous patches of ideas will develop into the constellations of truth. In fact, we stand mentally in the condition of one who, having been blind, receives some degree of light, and "sees men like trees walking."

When we can answer the questions I have asked, then comes in the possibility of guiding or correcting those processes constituting "amyloid degeneration," either in a preventative or curative way, but till then never, except it should be hit upon by sheer accident.

In Mr. Simon's "Report" from which I have previously quoted (page 79), he writes:—"Especially a leading fact in typhus, one which may be in intimate relation to the killing power of the disease, and which it is on all accounts necessary to have as completely as possible understood, is the fact of the action on the nervous system; and clearly no true chemical knowledge of that

morbid action would be possible till greatly improved knowledge of the normal brain chemistry should be supplied."

Mankind in general little reflects how much it owes to chemical science and to those chemists in particular who have devoted their lives to the sake of truth. What familiar substances are chloroform and chloral, and how much gratitude ought to be experienced by us towards the eminent discoverer of these bodies—the late illustrious Liebig? While nearly all of us have escaped from pain by the application of the one, or enjoyed sleep by the use of the other of these substances, there are many who are ignorant alike of their discoverer, and the processes by which they are obtained, caring still less to learn how these wonderful bodies exert their benign influences. These influences are doubtless the result of reactions on brain- and nerve-matter, but what these reactions are is a question from the solution of which we are perhaps as far removed as from any ultimatum in science. But we shall know hereafter. Meanwhile science is struggling hard to obtain an insight into these profound processes, and perhaps this is the right place to briefly notice those recent researches of Messrs. J. G. M'Kendrick and Dewar on the physiological action of certain bases of the so-called chinolin and pyridin series.

These observers administered these bases, which are derived from quinine and allied bodies by distillation with potash, and which constitute two homologous series, by subcutaneous injection. Now M'Kendrick and Dewar find that the physiological action of these bases, which consist of carbon, hydrogen, and nitrogen in varying atomic proportions, is entirely upon the various parts of nerve- and brain-matter, but further, they have encountered some striking facts which seem to show that the intensity and sort of action is related in each case to the chemical composition and constitution of these bases. Here I shall only quote one conclusion they infer from their observations. (See *Proc. Roy Soc.*, vol. xxiii., p. 297). It is as follows:—

"On comparing the action of such bases as C_9H_7N (chinolin) with $C_9H_{13}N$ (parvolin) or $C_8H_{11}N$ (collidin), with $C_8H_{15}N$ (conia from hemlock) or $C_{10}H_{10}N_2$ (dipyridin), with $C_{10}H_{14}N_2$ (nicotine from tobacco), it is to be observed that, apart from difference in chemical structure, the physiological activity of the substance is greater in those bases containing the larger amount of hydrogen."

Here the conclusion drawn is only the fact expressed in another way, but of course much more work is necessary before this can constitute or prove to be a law. This work must endeavour to ascertain what becomes of the substances subcutaneously injected, and *how* they act on the centres of the brain organisation. Let us consider that 1 grain of some of these bases per pound of weight (for a rabbit) is sufficient to cause death, and we can readily conceive the difficulty encountered in endeavouring to trace the substance itself through the system, although we know it must act by way of the blood. Beyond this human efforts have not yet extended, and in these particular cases the effects have been witnessed, while the causes are almost entirely hid.

It is not necessary for me to dwell long on the importance of acquiring knowledge relative to the brain in particular; for seeing it is the "seat of powers, essential to the production of those phenomena which we term intelligence and will" (Huxley); seeing that from it spring those nerves through the functions of which we enjoy the uses of our principal and subordinate senses; seeing, indeed, that the whole body of man is in a sort of subordination to his brain and nerves,—is it necessary for us, who are the beings concerned, to ask what importance is to be attached to research, be it chemical, physiological, or otherwise, conducted upon these matters? We should rather take up the maxim of the old alchemists, of "those mistaken but often grandly energetic men, who said to the disciples of their art," as Mr. Rodwell has told us (in his "Birth of Chemistry"), "Ora! Lege, Lege, Lege, Relege, Labora, et Invenies."

Our slight knowledge of the constitution of bodies occurring in the human system, and of the processes by which they are built up from food, and transformed into ultimate products after fulfilling the vital functions, only shows how much yet remains to be learnt. We soon perceive that we stand but on the threshold of knowledge, and many must be the thinkers and workers, and generations upon generations will pass away, before the processes of life shall stand forth entirely revealed; before it shall be known how from a few simple matters, tolerably well known themselves, and administered as food, is built up man, with his marvellous and beautiful structure,—with his power of thought, feeling, and action. That such a time will come scientific men have no doubt; we shall know more to-morrow of the sun that shines to-day!

Let us for one moment consider the value of knowledge which must prove so powerful in preventing or curing those diseases which now so often fritter away men's lives in misery and suffering. All knowledge leads to happiness of mankind; the discovery of a new dye gives rise to a new industry, and places in the hands of man that which—by pleasing his taste—increases his happiness; and so, to quote from Bacon, all those "industrious observations, grounded conclusions, and profitable inventions and discoveries" (see Macaulay's "Essay"), are securities for the health and comfort of man.

The processes of life are involved in such darkness at present as to make one very cautious in expressing or accepting statements made regarding them, but when there is scientific evidence, as there is in the cases we have considered, and when expressed views explain well what occurs, those views are entitled to respect. For although I have said there is darkness around the vital phenomena, that darkness exists only because Science as yet has not attacked Nature sufficiently in these directions. But a continuation of work will dispel doubts, will abolish untruth and mystery often amounting to superstition, and will substitute a rational explanation of life and the chemical processes which sustain it. There will always exist men who will doubt the possibilities of science,—who will call in question matters which have been established as truth, just as men—even to Bacon—rejected the doctrines of Galileo, and as Liebnitz spurned the philosophy of Newton on gravitation. But, in spite of all, the sun of Science will dispel the morning clouds of ignorance and prejudice, and will unfold to us the laws of Nature, unbiassed by the poetry of man's mind and free from the superstitions of churches.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, February 17th, 1876.

Professor ABEL, F.R.S., President, in the Chair.

After the minutes of the previous meeting had been read and confirmed, and the list of presents to the Society announced, the President, in accordance with the by-laws, read out the names of the Officers and Council proposed for the ensuing year. Messrs. J. S. Walton, G. Head, J. H. Starling, P. J. Winser, J. Davison, P. Holland, and A. A. Nesbit were then nominated; and Messrs. George William Typke, Francis S. Earp, Henry Mitford Faber, B.A., Gerrard Ansdell, John May Herbert Munro, N. Bettson Cooke, Walter Pearce, George Harrow, John Parry, William Ashwell Shenstone, and Charles Williams were balloted for and duly elected, after their names had been read the third time.

The PRESIDENT said he had been requested by the Committee of the Council for Education to call the attention of the Fellows to the proposed loan exhibition of scientific instruments, and to invite the Fellows to send chemical specimens or apparatus of historical or scientific interest. He also had to announce that Prof. Andrews, of Belfast, would deliver a lecture "On Certain Methods of Chemical Research," on Friday, April 28. The thanks of the Fellows were due to Mr. James Duncan for the handsome marble bust of Dr. Hofmann which he had given to the Society. It was a most lifelike and spirited likeness of that eminent chemist.

The PRESIDENT then called on Professor Frankland to deliver his lecture "*On Some Points in the Analysis of Potable Waters.*"

The LECTURER said it was now eight years since he had the honour to lay before the Fellows an account of the principal methods for water analyses. The result of that investigation was that of the four processes used for the estimation of the organic constituents, viz., the "ignition," "permanganate," "albumenoid ammonia," and "combustion" methods; the last mentioned was the only one yielding trustworthy quantitative results. The two chief objects to be kept in view were the estimation of *present* organic impurities, and the evidence of *past* pollution, both of which were of incalculable importance from a sanitary point of view. This the Lecturer illustrated by a most striking case of the propagation of typhoid fever at the village of Lausen, in Switzerland. The previous animal contamination of water, as deduced from chemical analysis, must always be regarded as a minimum quantity, since we look in vain for the full evidence of such contamination in the effluent water from fields irrigated with sewage: aquatic vegetation also slowly removes these compounds from water, and they are likewise destroyed by putrefaction. The actual present organic matter in water can only be ascertained by the estimation of the carbon and nitrogen; and experiments made by adding known quantities of organic substances to pure water, and then analysing them, showed that the average error did not exceed 1-22nd of the total amount present. This difference would have no appreciable effect on the opinions of an analyst respecting the quality of a water.

The Lecturer then proceeded to describe the improvements which had been made in the process as originally described by Dr. Armstrong and himself; the chief of which consisted in the evaporation of the water under a glass shade. The water by this means was brought in contact with but a limited quantity of air, and yet the evaporation took place almost as rapidly as when it was freely exposed.

The Lecturer then described the diagrams, the curves in which illustrated the amount of organic matter in the water supplied during the past eight years by the eight London water companies, pointing out how floods were invariably accompanied by an increase in the amount of organic matter present in the water; besides many other interesting points, such as the effect of the decay of vegetation in autumn; the advantages and disadvantages of large storage power; and the danger of surface leakage in improperly constructed reservoirs, as most strikingly shown by the analyses of the Kent company's water in the years 1868 and 1869. These diagrams, giving as they do the results of more than eight hundred analyses, showed most distinctly that the combustion method of analysis was competent to reveal the finer shades of quality in water drawn from the same source, but treated differently by the various water companies. Against these advantages it must be acknowledged that the process involved more trouble and more careful manipulation than were usually bestowed upon "commercial analyses;" but, at the same time, there was no more simple method by which trustworthy quantitative results could be obtained.

The albumenoid ammonia method of determining organic nitrogen rarely gave the total nitrogen present in organic bodies as ammonia, and, what is of more importance, the proportion evolved varied very widely with different kinds of organic matter. This was shown by the results obtained by Messrs. Wanklyn, Chapman, and Smith with twenty-five different nitrogenous substances, of which only five yielded approximately the whole of their nitrogen as ammonia: of the remainder, some evolved one-half, some one-third, one-fourth, or even none of their nitrogen as ammonia. From this it was evident that this process could give no evidence whatever touching the proportion of organic matter present in waters; neither could it indicate the relative quantities of organic nitrogen, even in different samples, unless the proximate constituents of the organic matter happened to be of the same kind, and in the same relative proportions; a coincidence which could obviously seldom or never occur. It was not surprising, therefore, that great irregularities and discrepancies should occur in the results obtained by this process, and those furnished by the combustion method. An opinion based upon the albumenoid ammonia method must almost necessarily be erroneous, like that to which the authors of the process themselves were led when they declared the water of Bala Lake and that supplied to Manchester from the Derbyshire hills to be no purer than Thames water. To sum up:—

1. The albumenoid ammonia process affords no evidence of the absolute quantity either of the organic matter or of organic nitrogen present in potable water.
2. It does not indicate, even approximately, the relative quantities either of organic matter or of organic nitrogen in different samples of such water; and—
3. It affords no indication either of the presence or of the proportion of *albumenoid* as distinguished from other nitrogenous organic compounds.

The applause with which the lecture was received having subsided,

The PRESIDENT said whatever difference of opinion might exist amongst those present as to the comparative value of the method advocated by Dr. Frankland, there could be no doubt as to the unanimity with which they had expressed their thanks to him for his excellent lecture. He thought it would be as well to confine the discussion, as far as possible, to three principal points—(1) The question of pre-existing sewage contamination; (2) the direct determination of carbon and nitrogen by combustion; and (3) the value of the so-called albumenoid ammonia process. Although the advanced hour precluded their entering fully into the subject, he would at all events ask Mr. Wanklyn if he would be good enough to open the discussion.

Mr. WANKLYN said it was pretty nearly eight years ago since he had been at any of the meetings of the Society, and almost the last time he was there he had urged objections against the process of Frankland and Armstrong, which had not been answered. There were objections to it as a process of manipulation. If a sufficiency of an organic substance were taken, say, 0·200 grms., by careful manipulation the carbon could be determined within 1-200th of the amount, and the process for nitrogen was about as accurate. The limit of error being about 0·5 milligrm. on the carbon when 0·2 grain substance was taken, whilst Dr. Frankland only took about 0·02 grain, it was necessary to show that the possible error was diminished by at least one-tenth, or to within 0·05 milligrm. He did not believe that any improvement in the manipulation would overcome this difficulty. In the experiments which the Lecturer had made to test his process by weighing out known quantities of nitrogenous substances, and adding them to pure water, he had omitted to add any nitrate. Now one of the greatest difficulties which were encountered was to destroy the nitrates without affecting the organic constituents. He would also advert to one other objection which was fundamental, as it was inherent to the process, and could not be avoided by any manipulation, however careful. If sawdust was moistened, and

a current of air passed over it, it was found that carbonic acid was produced: prolonged exposure to moisture in presence of atmospheric oxygen changed it. How much more likely that the prolonged exposure of the organic matter in water at a high temperature in presence of air should change it; a portion of the organic matter of the water was sent into the air, and Prof. Frankland made a combustion of the remainder. An objection which the Lecturer urged against the albumenoid ammonia process was that the results obtained by it and by his method did not agree: he never expected they would. It was not professed that the process showed the total organic nitrogen. By taking albumen, and treating it by one modification of their process, you could obtain the whole of the nitrogen as ammonia, and by another modification only a definite fraction of it, and yet he had deliberately rejected the former and adopted the latter for the determination of nitrogen in waters. When he obtained ammonia from water by this process, the amount of ammonia expressed rigidly the total amount of albumen and albumenoid substances in the waters.

Dr. Warren De la Rue said he did not rise to make any remarks on water analysis, but thought that as the subject was one of great interest it would be better to adjourn the discussion until the next meeting.

The President accordingly adjourned the discussion until Thursday, March 2.

CORRESPONDENCE.

PRODUCTION OF ANILINE-BLACK BY MEANS OF VANADIUM SALTS.

To the Editor of the Chemical News.

Sir,—In the Chemical News, vol. xxxiii., p. 70, I observe an article copied from the *Bulletin de la Société Chimique de Paris*, "On the Production of Aniline-black by Means of the Salts of Vanadium," by M. A. Guyard, which commences thus:—"Since the interesting discovery of M. Pinkney is known," &c. Permit me to say that although this may be a discovery of M. Pinkney, it was known and published in 1871 by Mr. John Lightfoot, the original inventor of aniline-black.

In a pamphlet entitled "The Chemical History and Progress of Aniline-Black," printed for private circulation, and of which a copy was sent to every calico-printer in Great Britain who was accustomed to print this colour, at page 32 Lightfoot gives the result of experiments on producing aniline-black, in which he successively tried the following metals:—"Copper, iron, *vanadium*, uranium, nickel, lead, zinc, antimony, tin, manganese, chromium, bismuth, arsenic, titanium, tungsten, cadmium, tellurium, molybdenum, mercury, silver, gold, platinum, palladium, rhodium, iridium, aluminium, osmium, cobalt, ruthenium, thallium, magnesium, indium, rubidium, cerium, glucinum, zirconium, lanthanum, didymium, erbium, yttrium, selenium, tantalum, niobium. The cloth was aged for twelve hours in a warm moist room, then washed in soap and water. The result was this:—*The greatest development of the black was due to the vanadium*; next in order was copper; then uranium; and, lastly, iron. Except very slight shades of blue no action was apparent from any of the other metals.

I know that the late John Lightfoot went to very great expense to procure specimens of all the metals above enumerated in a pure state.—I am, &c.,

James Higgin.

Manchester, February 21, 1876.

VANADIUM.

To the Editor of the Chemical News.

Sir,—Referring to a paper which appeared in the Chem. News (vol. xxxiii., p. 70), written by M. A. Guyard, it may interest your readers to know that we have been enaged for some years in developing the sources of the rare and hitherto costly metal vanadium, and in the extraction and preparation of its salts on a large scale, which we are now in a position to supply at a price, and in sufficient quantities, to make it commercially available.—We are, &c.,

Johnson, Matthey, and Co.

Hatton Garden, February 23, 1876.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences. No. 5, January 31, 1876.

Thermic Researches on the Formation of the Alcohols, and on Etherification.—M. Berthelot.—A thermo-chemical paper, not suitable for abstraction.

Account of Experiments undertaken for the Determination of the Work Performed by the Magneto-Electric Machines of M. Gramme, used for the Production of Light in the Establishment of MM. Sautter and Lemonnier.—M. Tresca.—As regards the relative expense of different modes of lighting the following figures may have a certain interest:—1850 Carcel burners would require a consumption of $1850 \times 0{\cdot}040$ kilo. of oil $= 71$ kilos. of oil per hour; or of $1850 \times 0{\cdot}105$ cubic metre of gas $= 194$ cubic metres; or of $7{\cdot}56 \times 4$ kilos. of coal (used in furnishing power for the Gramme machine) $= 30{\cdot}24$ kilos. of coal. Under these circumstances the outlay in fuel does not represent more than the one-hundredth part of the cost of oil, or the fiftieth part of the cost of gas, taking Paris prices. The applications of the magneto-electric machine for lighting are multiplying.

Researches on Rotatory Magnetic Polarisation.—M. H. Becquerel.—It results from these researches that the molecules of bodies submitted to the action of magnetism interfere by their specific action with the phenomenon of the rotation of the plane of polarisation of light, and that for highly magnetic bodies this action varies with the mutual distance of the active molecules.

Formation of Hail.—M. G. Planté.—This paper requires the accompanying illustrations.

Congelation of Mercury by the Use of a Mixture of Snow and Hydrochloric Acid.—M. G. Witz.—If the acid is previously cooled to $-15°$ or $-16°$ the final temperature attained, with equal weights of snow and acid, is from $-32°$ to $-35°$. If the acid is cooled down to $-18°$ mercury may readily be frozen on the large scale.

Ferment of Urea.—M. Musculus.—The ferment of urea has none of the characteristic properties of organised ferments. It has much resemblance to the soluble ferments, such as diastase, saliva, &c. It is not capable of converting acetamide, oxamide, &c., into ammoniacal salts.

Elements of Inverted Sugar, and on their Presence in Commercial Sugars.—M. E. Maumené.—Not suitable for abstraction.

Reimann's Farber Zeitung, No. 3, 1876.

Recognition and Examination of Eosin.—Although eosin in body is distinguished from the red coal-tar colours—magenta, saffranin, and corallin—by its greater solubility in water, and by the splendid fluorescence of the solution, it may often be necessary to examine if this costly dyeware is unsophisticated. For this purpose the best reagent is sulphuric acid diluted with four volumes of water. With this liquid magenta and corallin yield a golden-yellow, and saffranin a violet-blue solution, whilst eosin remains quite undissolved, forming an orange-red coagulum. If previously in solution it is precipitated by

the dilute acid, whilst possible impurities remain dissolved, and can be subjected to further examination. To detect eosin upon the fibre a concentrated aqueous solution of sulphate of alumina (1 part in 4 of water) is proposed, the reaction ensuing being produced by no other dye-ware. The lakes—*i.e.*, the compounds of tinctorial acids with basic mordants—are well known to be soluble in the solutions of certain salts of alumina and tin. On treating a pattern of dyed cloth with a hot solution of sulphate of alumina the lakes of cochineal, and all other natural red colours, are stripped; tar colours—such as magenta, corallin, and saffranin—dissolve as such, whilst eosin-red remains almost completely untouched. Eosin yields lakes with the oxides of the heavy metals, which, unlike the lakes of cochineal and the woods, are soluble in water, but insoluble in precipitants, as in this case in the sulphate of alumina.

Les Mondes, Revue Hebdomadaire des Sciences, No. 4, January 27, 1876.

This issue contains no chemical matter.

No. 5, February 3, 1876.

Among the instances of progress in applied chemistry mention is made of artificial butter!

MEETINGS FOR THE WEEK.

SATURDAY, Jan. 26th.—Physical, 3. "On some Problems connected with the Flow of Electricity in a Plane," by O. J. Lodge. Exhibition of a Tangent Galvanometer for Projection, by A. Haddon.
MONDAY, 28th.—Medical, 8.
— London Institution, 5.
— Royal Geographical, 8.30.
TUESDAY, 29th.—Civil Engineers, 8.
— Royal Institution, 3. "On the Classification of the Vertebrated Animals," by Prof. Garrod.
WEDNESDAY, March 1st.—Society of Arts, 8. "Aquaria, their Construction and Management," by W. Saville-Kent, F.L.S., F.Z.S.
— Microscopical, 8.
— Pharmaceutical, 8.
THURSDAY, 2nd.—Royal, 8.30.
— Royal Institution, 3. "On the Chemistry of the Non-Metallic Elements," by Prof. Gladstone.
— Chemical, 8. Discussion on Dr. Frankland's Lecture on "Water Analysis."
— Royal Society Club, 4.30.
— London Institution, 7.
FRIDAY, 3rd.—Royal Institution, 9. "The Paraffins and their Alcohols," by Prof. Odling.
— Geologist's Association.
— Society of Arts, 8. (Indian Section.) "The Fall in the Price of Silver; its Causes, its Consequences, and their Possible Avoidance, with especial reference to India."
SATURDAY, 4th.—Royal Institution, 3. "On the Vegetable Kingdom," by W. Thiselton Dyer.

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TO ANALYSTS.

GLAMORGANSHIRE.

The Justices of the County of Glamorgan having at their last quarter Sessions resolved to appoint Analysts for such County, invite Candidates for the Appointment to send Testimonials and Certificates of Qualification, addressed "Application for Analyst," under cover, to the Clerk of the Peace, Cardiff, on or before the 1st day of March next. The duties of such office are prescribed by the Act of 38 and 39 Vict., cap. 63, and the following Resolutions were adopted by the Court:—

That the Court proceed to the Election of an Analyst or Analysts for the County, at the next Easter Sessions, and that the Rules laid down by the County of Oxford be adopted in this County, and that the Fees to be paid be as follows:—

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For every Analysis and Certificate	0	15	0
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To each Analyst upon compulsorily attending as a Witness at the place where he resides, in each case	0	10	6
If elsewhere Threepence per mile, going and returning, and	1	1	0

The Clerk of the Peace was directed to advertise in one or more of the London, and the usual County papers, inviting applications from persons desirous of being elected Analyst, requesting them to send him their Testimonials by the 1st of March next.

THO. DALTON,
Clerk of the Peace.

Cardiff, January 24, 1876.

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THE CHEMICAL NEWS.

VOL. XXXII. No. 849.

ORGANISATION AMONG CHEMISTS.

As our readers must be well aware, we have for some time embraced every opportunity of calling the attention of professional chemists to the necessity of an organisation, such as has been adopted by every other profession. So far our remarks—in appearance at least—have met with little response. But the able paper by Dr. C. R. Alder Wright (CHEMICAL NEWS, vol. xxxiii., p. 27) encourages us to persevere.

In support of our view that the sphere of the chemical profession is being encroached upon by outsiders, we will bring forward two unmistakable modern instances. The Board of Trade have recently appointed a Water Examiner. Now a water examiner should be a chemist and a microscopist. Yet the gentleman appointed is an engineer! Turning to a closely connected matter, what can be more evident than that the treatment of sewage is a chemical question? The distinction between sewage and pure water is a chemical distinction. The methods of removing the impurities depend on chemical principles, and chemistry alone can decide whether any sewage or refuse water is sufficiently purified to be safely admissible into rivers. Yet at a meeting of the Society of Engineers, recently held in Westminster Chambers, the President, Mr. Vaughan Prendred, in the course of his address observed:—"The sewage question was the great question of the day, and it would require their (the engineers') deepest thought and utmost skill." There exists, in fact, already a Society of Sanitary—not Chemists—but Engineers. Thus, without prompt and vigorous action, we shall see this important matter taken entirely out of our hands, the main credit and the main emoluments falling to those who merely execute the subsidiary portion of the work.

Dr. Alder Wright very justly comments on the low salaries paid to Public Analysts. Of this we have had lately a signal instance. A certain borough munificently awards its analyst fees which range from half-a-crown to ten shillings. Can our readers name any analytical operation which can be fairly and conscientiously performed for half-a-crown? But this evil of low fees—which leads of necessity to slovenly and hurried work and the use of impure reagents—has been fostered by some men of standing. There are chemists holding public appointments so forgetful of what is due to themselves and to their professional brethren as to undertake analyses and investigations at a far lower rate than an engineer, a physician, or a barrister would require for a similar demand upon his time and attention. We have seen advertisements in which a chemist actually offered to give his services gratuitously to any manufacturing establishment. No such cases occur in better organised professions. We must beg to remind manufacturers who feel tempted by such offers that unpaid services are in the long run the dearest of all. Persons who do not need to take fees or salaries, instead of degrading the profession by doing commercial analyses at starvation prices, might serve science better by devoting their time to original research.

To accuse any professional chemist of incompetence is an exceedingly delicate matter. Yet the fact that "high" and "low" analysts exist, and that they are known and sought after when occasion serves, cannot be overlooked. Some of those who make the loudest outcry when led astray by the certificates of such practitioners shun consulting any conscientious and skilful chemist: We know a case where certain speculators, who had an iron mine to dispose of, sent a sample of the ore to a chemist of undeniable skill and sterling integrity, with a nicely-worded intimation that if he made it come out satisfactorily he would receive many samples of ores and minerals. In his report he stated the exact truth, which was not very flattering, and as a matter of course never received another sample. We have sometimes heard the opinion advanced that brokers and merchants always detect and shun the incompetent chemist or assayer. We doubt this statement. We have heard of a chemist—probably now long ago resolved *in terram damnatam*, as old Helmont hath it—who in alkalimetry used to determine the point of saturation by placing a drop of the liquid upon his tongue, and who generally made every sample from 1 to 1·5 per cent better than the reality. Yet the brokers clung to him with a faith perfectly touching. Whilst fully of opinion that such black sheep cannot be excluded from the flock except by means of organisation, we must remember that the need for union would still exist even if every member of the profession were skilful and honourable. To belong to an organised body known to be willing and able, on the one hand, to watch over the interests of its members, and on the other to impose a proper restraint upon them if they go astray, is an incalculable benefit. So long as the profession is unorganised clients know that if one chemist will not accept insufficient fees, or give sweeping certificates in favour of questionable commodities, another will be glad of the opportunity. But the moment all chemists are bound, as they ought to be, by a strict professional etiquette, all this will come to an end. Those who are not disposed to pay fairly for chemical advice will not be able to get it at all.

We may add that we are not actuated by any ill will to that profession which has been most conspicuous for its successful encroachments on the province of chemists. It has before it a wide and almost infinite career where there is full and legitimate scope for the talents and energies of its members. But we likewise have our sphere into which none but chemists have the right to enter. The great principle of the division of labour, still more important in intellectual matters than in mere manual affairs, forbids any man from being at once chemist and engineer.

The following advertisement, which we find in the columns of a morning paper, gives confirmation strong of the low position to which chemistry as a profession has fallen:—

> Wanted, a Young Man capable of making a thorough chemical analysis of water, competent to direct workmen, must know Latin well, and have some knowledge of accounts; salary £2 per week; security required.—Apply, &c.

Were the profession organised, no chemist would undertake to analyse waters for a salary amounting to less than half the wages of a collier; or would, on any terms, consent to do the work of a messenger, a clerk, or a foreman, or to find "security."

Mr. A. H. Allen's letter, inserted in this week's issue, supplies additional confirmation—if such were needed—of the necessity for organisation. So long as there exists no method of excluding unqualified pretenders from our ranks we shall never be regarded as a learned profession, either by the legislature or the public. But we do not feel at liberty to adopt Mr. Allen's proposal to take the Society of Public Analysts for the nucleus of the proposed Guild. He himself supplies an argument against his suggestion in remarking that "many of the Public Analysts under the Sale of Food Act are quite unused to general analysis, and would never desire nor expect to be recognised as members of a guild of qualified analytical chemists." But we scarcely see how Mr. Allen's scheme is to be carried out without extending the membership of the guild to all the members of the Society. It will be remembered that when the Society of Public Analysts was first constituted something of the kind was mooted, but the majority of the Public Analysts present deemed it more prudent to confine their views to the object more immediately in hand.

We should like to know the exact nature and aims of a body calling itself the "Chemical Science Association," the existence of which we first learned from the report of certain proceedings taken against a firm of chemical manure manufacturers for an alleged nuisance. One of the witnesses for the prosecution described himself as a member of the Association in question.

We shall be very happy to receive communications from our readers on the most practical method of effecting what is so urgently required.

LABORATORY NOTES.

By SIDNEY LUPTON, M.A.

1. *Preparation of Nitrogen.*

NITROGEN in quantity is generally prepared by leading air over copper-turnings ignited in a glass tube. Oxide of copper is formed, and nitrogen passes over alone—

$$(2N_2+O)+Cu=CuO+2N_2.$$

A considerable length of copper must be heated, and the reaction comes to an end when the copper is somewhat thickly coated with oxide.

It was suggested to me by Mr. Vernon Harcourt that if the air was mixed with ammonia by bubbling through a strong aqueous solution, the oxide of copper would be reduced as fast as it was formed, and the reaction would be continuous as long as the solution contained any ammonia. Air and ammonia would give nothing but water and nitrogen—

$$3(2N_2+O)+2NH_3=3H_2O+7N_2.$$

On trying the experiment I found that about 3 inches of copper-turnings, heated by an ordinary Bunsen burner, served to replace the long furnace and combustion-tube of the ordinary method, and that the slightest excess of air shows itself by tarnishing the surface of the turnings. Indeed, by this method I have several times prepared nitrogen so pure that a stream of it did not alter the surface of fused potassium.

2. *Solubility of Naphthalen in Water.*

Naphthalen is generally stated—I think on the authority of Garden—to be insoluble in cold water, and but slightly soluble at the boiling-point. It is found, however, that naphthalen, like camphor, moves spontaneously when placed upon the surface of water. According to the theory of Platteau these movements are due to the high surface-tension of a solution of the moving solid. Hence this theory must be laid aside if Garden's statement be absolutely correct.

Naphthalen, purified by re-sublimation through filter-paper, was boiled for some time with distilled water; the solution was allowed to cool to the temperature of the room, and filtered twice through Swedish filtering-paper. A portion of the solution was evaporated to dryness on the water-bath; no residue was left, since naphthalen is very volatile in steam, and this may have occasioned Garden's statement. Another portion of the solution was heated in a glass bulb, and the boiling-point taken by a thermometer immersed in the liquid: it was 103° C., a small piece of clean platinum wire occasioned no change. The boiling-point of freshly-boiled distilled water was then taken under exactly the same conditions; it was found to be 102·4° C., and after throwing in the clean platinum wire 102·1° C.

On another occasion the solution was made from ordinary filtered water; the boiling-point, with or without the platinum wire, was found to be 103·2° C., that of the water itself being 101·4° C., or with the platinum wire 101·3° C.

From these experiments it seems that sufficient naphthalen remains in solution to alter the boiling-point at least half a degree, and that Garden's statement cannot be taken as being absolutely correct: hence no doubt is thrown on Platteau's theory. It may be remembered that camphor itself is but very slightly soluble in water.

3. *Tests for Aniline.*

a. When aniline is boiled with a dilute solution of chloric acid, the colour changes through mauve, magenta, and vermillion to a clear reddish yellow liquid. Naphthylamin, under the same conditions, passes through blue-black to light yellow.

β. When aniline is boiled with excess of potassium ferricyanide, the yellow solution changes to a deep chrome-green. After longer heating a blue-black precipitate falls, apparently similar to that obtained by Letheby by the electrolysis of salts of aniline. Naphthylamin, under the same circumstances, forms a yellow-green solution, with separation of a red resin.

γ. When aniline is heated with a 1 per cent solution of osmic acid a thick, black, flocculent precipitate falls. Naphthylamin, under the same circumstances, forms first a purple solution, and after longer heating a brown precipitate.

4. *Tests for Succinic Acid.*

a. Nitrate of uranium, when added to a neutral succinate, forms a very sparingly soluble pale yellow precipitate, which is soluble in acetic acid, but insoluble in solution of oil of amber, alcohol, excess of succinate of ammonia, or acetate of soda. Uranium benzoate is almost identical in appearance and properties.

β. When nitrate of cobalt is added to a solution of a *neutral* succinate, the liquid changes to a peculiar purple or "peach blossom colour," and if the solution be concentrated a precipitate falls. On the addition of ammonia the solution so precipitated becomes more and more blue. This precipitate is soluble in acetate of soda. The presence of oil of amber seems greatly to facilitate the precipitation; as also does alcohol, but in this case the precipitate is pink.

Benzoate of cobalt is red when formed in the cold, green when produced at the boiling-point; it is very soluble.

ESTIMATION OF MANGANESE IN CAST-IRON.

By SERGIUS KERN, St. Petersburg.

THE following method is proposed for the estimation of manganese. The process is easily executed, though very accurate results are not obtained; but, however, in laboratories of iron works this method may be used, especially for the analysis of spiegeleisen.

0·5 grm. of the sample is dissolved in a high glass in 15 c.c. of hydrochloric acid, 1·12 sp. gr. At the end of this operation about 0·2 grm. of potassium chlorate is added in order to convert all the iron into ferric chloride. If silica occurs in the sample it is found in the form of a precipitate which is filtered from the solution. The liquor then contains ferric chloride (Fe_2Cl_6), and manganous chloride ($MnCl_2$). A solution of caustic potash is next added; $Fe_2(HO)_6$ and $Mn(HO)_2$ fall down as precipitates; to the solution is immediately added about 40 to 50 c.c. of a concentrated solution of ammonium chloride (NH_3HCl), and the mixture is boiled for about ten to fifteen minutes. The liquor is then filtered from the brownish-red precipitate of hydrated ferric oxide, and to the colourless solution ammonium sulphide ($NH_4.SH$) is added; a flesh-coloured precipitate of manganese sulphide (MnS) is obtained, which is filtered from the solution, quickly washed, placed in a porcelain crucible, and heated with sulphuric acid. Manganous sulphate ($MnSO_4$) is then obtained, which, evaporated to dryness and next ignited, yields red mangano-manganic oxide (Mn_3O_4). This oxide is weighed, and as it contains 72·05 per cent of manganese, the percentage of manganese in the sample may be easily calculated.

This process is based on the solubility of freshly precipitated $Mn(OH)_2$ in a concentrated solution of NH_4Cl, and on the insolubility of the hydrated ferric oxide in the same solution. My method has been used in several analyses of spiegeleisen with success, and thus may be proposed for the use of analysts.

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. [illegible])

THE difference in the effect can only be explained by the production of a far lower temperature. Within the entire machine also there is an excessive tension, so that the vapour seeks to escape at the joints, thus debarring the air from entering. The air-pump also is of much smaller dimensions as it draws and compresses a far denser vapour, thus notably reducing the loss of power due to the friction of the piston. If, however, the work is carried on at greater differences of temperature than in the common ether machine, the engine must expend more power, as appears from the theory of the air machine. For equal temperatures of evaporation and condensation the theoretical effect of the two machines is equal. Tellier keeps a sufficient quantity of methylic ether stored in cast-iron vessels capable of bearing a pressure of 10 atmospheres. On opening a cock the gas streams out, the liquid is cooled, and if the vessel is set in water this soon becomes frozen. The ether is thus certainly lost. Occasionally this method may be found useful.

Other substances of low boiling-points may, like the above-named ethers, be applied for producing a fall of temperature, but no different result can be expected from their theoretical action. Thus Van der Weyde, of New York, makes use of chymogen, a constituent of natural petroleum, evaporating between 0° and 16° C., of which, in the United States, a litre costs only 14 to 24 Pfennige (12 Pfennige = 1½d. English).† Liénard and Hugon, of Paris, are said to use sulphide of carbon.‡ An original proposal by Mort and Nicolle, which may be regarded as a combination of the above-described system with the following, will be considered below.

Application of Carbonic Acid.—Carbonic acid has been repeatedly proposed as an agent for the production of cold. In 1867, a provisional protection for this principle was taken out in England, but the patent was never completed. *A priori* carbonic acid cannot be regarded as a very suitable means for effecting a fall of temperature. It has, indeed, in comparison with all other materials hitherto proposed (except air), the advantage of cheapness, and in contrast to the ethers that of incombustibility, and therefore of freedom from danger. The pressure of the liquefied acid is, however, enormous, and hence the receivers require to be made very strong, and the connections occasion much difficulty. The temperature and tension of liquid carbonic acid show the following relations:—

Temp.—	−60°	−30°	−15°	−5°	0°	+10	+15°	+30° C.
	4·5	16	25	33	38	46	51	73

As the temperature at which the carbonic acid is condensed in the cooler cannot be lower than +10° C. the tension is then 30 atmospheres, and even at −30° C. a tension of 16 atmospheres would ensue.

At the Vienna Exhibition a peculiar attempt was shown to use carbonic acid as a means both for the production of power and of cold. The machine was constructed by L. Seyboth, of Vienna, and was contrived as follows:—

The carbonic acid, generated from sulphuric acid and iron-spar, was evolved in a closed receptacle at the pressure of 4 to 6 atmospheres.

(To be continued.)

* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzehends."

† *Deutsche Industrie*, 1869, 339.

‡ Private communication.

PAPYRUS EBERS:
THE EARLIEST MEDICAL WORK EXTANT.

By H. CARRINGTON BOLTON, Ph.D., of New York.

THE most ancient chemical manuscript extant is believed to be a Greek papyrus of Egyptian origin, preserved in the library of the University of Leyden, and supposed to date from the third century A.D. This manuscript has never been fully described; the little known of it is contained in *Kopp's Beiträge der Chemie*, vol. i., p. 97.

Some months ago, however, the literary and scientific world came into the possession of a work far surpassing in antiquity the Leyden manuscript, and of infinitely greater interest and value to the student of the history of chemistry. This remarkable work is a facsimile of an Egyptian medical treatise, written in the sixteenth century B.C., and consequently more than 3400 years old. Though strictly a medical work, it is of no less interest to the chemist than to the physician.

G. F. Rodwell, F.R.A.S., author of "The Birth of Chemisty," in a recent letter to the CHEMICAL NEWS, refers to our knowledge of Egyptian chemistry in the following language:—"When we remember that the science originated in Egypt, and that the very name is derived from an Egyptian source, we can but hope that, in the progress of Egyptian discovery, as valuable information in regard to the history of chemistry as has already been found in regard to astronomy may be brought to light."

This Egyptian papyrus is a first and opportune response to the desire herein expressed. The title reads thus:—

"PAPYROS EBERS, *das Hermetische Buch über die Arzneimittel der alten Ægypter in Hieratischer Schrift.* Herausgegeben mit Inhaltsangabe und Einleitung versehen von Georg Ebers. Mit Hieroglyphysch Lateinischen Glossar von Ludwig Stern. Mit Unterstützung des Königlich Sächsischen Cultus Ministerium. Wilhelm Engelman. Leipzig, 1875. Zwei Bände, folio."

Translated, the title is as follows:—

"PAPYRUS EBERS, the Hermetic Book of Medicine of the Ancient Egyptians, in Hieratic Writing. Published, with Synopsis of Contents and Introduction, by George Ebers. With a Hieroglyphic-Latin Glossary by Ludwig Stern. Under the patronage of the Royal Bureau of Education in Saxony. Leipzig: William Engelman, 1875, 2 vols. folio."

The papyrus of which this work is a facsimile reproduction was discovered by the archæologist Ebers, during his visit to Egypt, in the winter of 1872-73. Ebers and his friend Stern were residing at Thebes, collecting archæological data, and there became acquainted with a well-to-do Arab from Luxor, who brought to them for sale a modern image of Osiris, and a papyrus of no special value. Suspecting that the Arab was holding in reserve objects of greater interest, Ebers offered him a considerable sum for any remarkable specimens in his possession. This induced the Arab to return on the following day, bringing with him a metallic case containing a papyrus roll enveloped in mummy cloths. Ebers immediately perceived he had a prize, but was unable to command the large sum of money demanded for it, until provided with the means through the liberality of a German gentleman, Max Günther, travelling in that vicinity.

According to the Arab's account, the papyrus had been discovered fourteen years previously by a man since dead.

The original papyrus was discovered between the bones of a mummy in a tomb of the Theban Necropolis.

Ebers hastened back to Leipzig with his precious roll, and deposited it for safe keeping in the University Library of that city. And now, with the co-operation of an enterprising publisher, and the assistance of royal patronage, he places it at the disposal of the civilised world by reproducing it in these handsome volumes.

The papyrus, as received by Ebers, consisted of a single solidly-rolled sheet of yellow-brown papyrus, of finest quality, 0·3 metre wide and 20·23 metres long. It formed one enormous book, but was divided into 110 pages, which were carefully numbered. For purposes of preservation and exhibition in convenient form the roll has since been cut into several lengths.

The writing, which is exceedingly clear and regular, is partly in black and partly in red ink, the latter occurring at the heads of sections and in the expression of weights and measures. The characters are known as Hieratic, being a cursive form of the hieroglyphic method of writing, and bearing the same relation to the latter that our ordinary written hand does to printed characters. Hieratic script resulted from attempts to simplify the forms and outlines of the idiographic characters employed in hieroglyphic writing, which is essentially a combination of picture writing with a phonetic system. Hieroglyphics, in ancient Egypt, was the written language of the people, and Hieratic writing was chiefly confined to the sacerdotal caste.

The papyrus Ebers is so remarkably well preserved that not a single letter is lacking in the entire roll. The material of the papyrus itself, the inner bark of *Cyperus Papyrus*, was examined by Prof. Schenck, Professor of Botany in the University of Leipzig, who established its identity with that of similar rolls, and pronounced it of remarkably good manufacture.

The age of the manuscript was determined by a consideration of three points:—

1. Palæographic investigations of the form of the written characters.
2. Occurrence of names of kings.
3. Examination of a calendar which occurs on the back of the first page.

These data enable Ebers to assign the writing to the middle of the sixteenth century, or, more precisely, 1552 B.C. Accepting this date—and it has been established beyond reasonable doubt—the writing was prior to the exodus of the Israelites; in fact, according to the commonly received chronology, Moses, in 1552 B.C., was just 21 years of age.

The authorship of this ancient work is not revealed, but it bears internal evidence of being one of the six Hermetic books on Medicine named by Clement of Alexandria (200 A.D.).

The Egyptian priests, who were also the physicians, in order to give greater authority to their writings, were wont to ascribe them to their gods, and their codified medical knowledge was generally ascribed to the god Thuti (or Thoth). In proof of this Ebers quotes the following passage from page 1, lines 8 and 9, of the papyrus in question:—"Ra pities the sick; his teacher is Thuti, who gives him speech, who makes this book, and gives the instruction to scholars, and to physicians in their succession."

This god Thuti, also written Thoth and Taaut, is the famous Hermes Trismegistus of the Greeks, the same who was regarded by the alchemists of the Middle Ages with superstitious reverence as the father of alchemy. However this may be, all historians accord in representing Hermes as the inventor of arts and sciences. He first taught the Egyptians writing, invented arithmetic, geometry, astronomy, and music; gave laws to the people, and regulated their religious ceremonies.

At the time of Jamblichus, who lived A.D. 363, the priests of Egypt showed forty-two books, which they attributed to Hermes (Thuti). Of these, according to that author, thirty-six contained the history of all human knowledge; the last six of which treated of anatomy of disease, of affections of the eye, instruments of surgery, and medicines.

The papyrus Ebers is indisputably one of these ancient Hermetic works; a study of the Synopsis of the Contents, given further on, will justify this belief.

(To be continued.)

PROCEEDINGS OF SOCIETIES.

PHYSICAL SOCIETY.

February 26, 1876.

Professor G. C. FOSTER, F.R.S., President, in the Chair.

THE following candidates were elected Members of the Society:—The Rev. R. Abbay, M.A., and Mr. W. Bottomley, sen.

Mr. A. HADDON exhibited and described a form of tangent galvanometer, so arranged that by the aid of an electric lamp an image of the needle can be projected on the screen, and its deflections thus made evident to large audiences. A horizontal beam of light falling on a mirror inclined at 45° is thrown vertically upwards. In its path it meets with a glass box containing a lozenge-shape magnet about three-quarters of an inch long: above this needle is a graduated semicircle. The pivot supporting the needle is fixed in the centre of the glass plate which forms the bottom of the box. Above this box is a lens, and on the top of the whole is a second reflector parallel to the first. On either side of the needle is a hoop of stout brass wire, 14 inches in diameter, one end of each hoop being insulated by a piece of ebonite, while the other end is in metallic connection with a brass ring, which slides easily over the circular base of the instrument. The hoops are separated from each other by a distance equal to half the diameter of either hoop, *i.e.*, 7 inches. The instrument having been placed at a distance from the screen equal to the focal length of the lens, and the needle brought to zero by rotating the graduated scale, the hoops are placed parallel to the magnetic meridian, and the instrument is ready for action. As an illustration of the manner in which the galvanometer is employed, Ohm's law was proved in the cases of large and small external resistance.

Mr. O. J. LODGE, B.Sc., then described some investigations on which he has recently been engaged in reference to the flow of electricity in plane bounded surfaces, in continuation of a paper read before the Society in the early part of last year, by Prof. G. C. Foster and himself. After some introductory considerations, he pointed out that all the conditions of the flow of electricity are known for any number of poles in an unlimited sheet. The problem, then, consists in reducing cases of poles in bounded plates to corresponding cases in the unlimited plane, such that the flow conditions on the bounding line may be the same in both cases. The determination of these data, however, for limited planes of certain forms, presents considerable difficulty. In studying questions of this nature, there are two kinds of lines which must be considered. These are "equipotential lines" *along* which no electricity passes, and "lines of flow," *across* which no electricity passes. The boundary of any conducting surface will, of course, always be a line of flow, and, in a bad conductor, we can form an equipotential line by laying a band of copper in the required direction. If, therefore, in studying a surface of limited extent in contact with an electrode we can find a point or points outside the surface such that, if they be made electrodes, the boundary line of the surface becomes a line of flow, we are at liberty to treat the surface as part of an infinite plane, and all the circumstances are therefore

known. To take the simplest case: a straight line in an infinite surface will be a line of flow if equal sources be placed in pairs on opposite sides of the line, so that one is the virtual image of the other; but if the components of each pair are of opposite sign it becomes an equipotential line. To make a circle of radius (r) an equipotential circle, we require a source, A, within, and a sink, B, without, such that $CA.CB = r^2$. To make it a line of flow we require two sources, such that $CA.CA^1 = r^2$, and an equal sink at C, the centre of the circle. The cases of an infinitely long straight strip, and of a surface bounded by two straight lines inclined at an angle δ, were then referred to, and Mr. Lodge showed that the first requires an infinite number of external sources arranged on a straight line, and the second an infinite number on a circle, except when δ is a sub-multiple of π, the number then becoming finite. Diagrams of the images for certain cases of triangles and squares were also shown. The dimensions of the electrodes in contact with conducting surfaces are not matters of indifference. In a plane bounded by straight lines the electrodes within and without the boundary are of equal size, but when the boundary is a circle the areas of electrodes vary as the squares of their distances from the centre. It was then pointed out that not only the poles may be reflected in this way, but also every point in the sheet; and if the lines of flow or of potential are drawn inside a given circle for any arrangement of poles, the lines outside can be immediately obtained from them by inversion with regard to the centre of the circle by means of a Peaucellier cell. The author then described the manner in which the principle of Wheatstone's bridge can be employed for tracing out lines of equal potential. If A and B be a source and sink on a conducting ring, and P any point on the ring between A and B, and Q any point between B and A, then P and Q are of equal potential whenever—

$$\frac{PA}{PB} = \frac{QA}{QB}.$$

If now the wire under the point P be flattened out into a surface, the above expression holds good for a certain line on that surface, which is therefore an equipotential line. Similarly, by flattening out the wire under the point A, the line for which the expression then holds good is a line of flow for a certain distribution of poles. [At this point the reading of the paper was adjourned to the next meeting of the Society.]

Prof. McLeod exhibited a glass plate covered with a film of silver, which had in places been deflagrated by means of Leyden jars; the poles being placed at varying distances apart. The form of the surface acted upon tended towards the lemniscate of Bernouilli.

NEWCASTLE-UPON-TYNE CHEMICAL SOCIETY.

General Meeting, December 24th, 1875.

John Pattinson, President, in the Chair.

The minutes of the previous meeting were read and confirmed.

The name of Mr. W. F. Henderson, 35, Leazes Terrace, was read for the first time.

Mr. Richardson said he wished to make a correction with respect to what he stated at the last meeting on the subject of working the tanks in continental chemical works. He said that the first liquors which came from the tanks were used for making carbonate of soda, and that the later liquids containing sulphide were used for making caustic soda. He had since referred to his notes, and he found that the cold liquor first drawn off contained caustic soda. Afterwards the liquor contained carbonate of soda with a small quantity of sulphide; then carbonate of soda comparatively pure; and afterwards, when heat was applied, carbonate of soda largely mixed with sulphide.

Mr. J. W. Swan exhibited one of the balances constructed by Herr Bünge, Mechanikus, Hamburg, the detailed description of which would be unintelligible without a drawing. The advantages claimed for the new construction are:—

1. Extreme sensitiveness combined with "quickness." These are obtained by means of a very short and light, but strong beam of aluminum bronze.
2. Convenience in working.
3. Non-liability to derangement.

The President said he had found the five-inch beam exhibited to turn with 0·001 gr. when loaded with 100 grs., and with 0·002 when loaded with 1000 grs. in each pan.

Mr. Swan said it was guaranteed to carry 200 grms. and turn with 0·0001 grm. The balance shown had been carried about Newcastle, in bringing it to the meeting, exactly as it then stood. Mr. Swan also exhibited his own improvement on Scheibler's electric thermostat, and several of Mr. Fletcher's gas furnaces in action.

The thanks of the meeting were offered to him.

NOTICES OF BOOKS.

Report of the Public Analyst to the Town Council of the Borough of Portsmouth for the Year ending September 30, 1875. Portsmouth: H. Lewis.

Mr. G. Turner, Public Analyst for the Borough of Portsmouth, has officially examined one hundred and forty-five cases. Only four persons have been prosecuted, but he considers that there has been a marked improvement in the articles collected this year, especially milk and coffee. This is very satisfactory intelligence.

In the analysis of butter Mr. Turner finds the method of Angell and Hehner satisfactory, though it requires much time. This difficulty he has succeeded in overcoming by the addition of methylated spirit.

On the subject of milk he considers that the average total solids in milk are 12·5, or 1·5 higher than the standard adopted by the Society of Public Analysts. He evidently attaches no value to the results obtained by Dr. Voelcker and so eagerly welcomed by the champions of sophistication. In estimating the fat he prefers benzine to ether as a solvent, and allows the residue to digest over night. Mr. Horsley's process he does not find satisfactory. In one sample of milk, which otherwise came well within the standards, he found 1·617 of mucin and a substance insoluble in cold alcohol, possibly vegetable mucin. This subject, he thinks, would well repay investigation.

A Set of Chemical Labels for the Laboratory, Alphabetically Arranged. By Philip Harris and Co., Manufacturing Chemists, Bull Ring, Birmingham. January, 1876.

These labels are well arranged, boldly printed, and of convenient size for laboratory use. In our opinion, however, the compilers would have been wise to have simply stated facts. Present chemical theories will probably be old in the course of a year or so, and the system of notation adopted by Messrs. Harris, instead of helping the young student, will be a hindrance to him, unless indeed chemists make it a rule to re-label all their tests and reagents whenever a new system of notation becomes fashionable.

Production of Silk in France.—The gross weight of cocoons for the year 1873 was 9,883,580 kilos., valued at 68,614,802 francs. Of this amount 94 per cent was furnished by the eight southern departments of Le Gard, la Drome, l'Ardeche, Vaucluse, Bouches, du Rhone, Isère, and Hérault. In twenty-five other departments the production is insignificant, and in fifty-four others it is unknown. In 1874 the yield did not differ much from that of 1873.—*Les Mondes.*

CORRESPONDENCE.

ORGANISATION AMONG ANALYTICAL CHEMISTS.

To the Editor of the Chemical News.

SIR,—The article by Dr. C. R. A. Wright "On the Necessity of Organisation Among Chemists," ventilates a subject of the utmost importance, and it is therefore to be regretted that the ball set rolling by Dr. Wright should be in danger of stopping, as from the paucity of subsequent letters on the subject seems to be the case. No chemist who observes the signs of the times can doubt the necessity for some such guild as that suggested by Dr. Wright, but I think its advantages may be conveniently discussed in detail.

The formation of a guild of Analytical chemists would tend to reduce the number of unqualified men now calling themselves analytical chemists, and would effectually prevent further encroachments of a similar kind.

As an instance of the annoyance to which professional chemists are now subjected, I may mention that some years ago I heard a druggist say in the witness-box that he was an analytical chemist, though I have good reason to believe he never made an analysis in his life. The extent of his information may be imagined when I say that a youth, since then a pupil of mine, once went to his shop for some "hydrosulphuric acid" for private use, and was instructed by the analytical chemist to "put some water to sulphuric acid, which will make hydrosulphuric acid"!

Another class, generally very ready to quack as chemists, though remarkably tenacious of its own privileges, is that of the pseudo-scientific medical men. One of my acquaintance belonging to this class is very fond of talking of the "quantitative analysis he saw when assistant to Professor Brande, forty years ago," while another recently expressed an opinion that "iodide of potassium could not be accurately estimated in admixture, but he supposed it would be best accomplished by means of starch"! Unfortunately, the ignorance of these pretenders is not understood by the public, and their results and opinions are liable at any time to be quoted as gospel.

I have myself suffered considerably from my liability to jury-service, and have no doubt other chemists have been similarly inconvenienced. Pharmaceutical chemists, medical practitioners, &c., are exempt from jury-service, and I fail to see why analytical chemists should not have similar advantages. Of course no such concession can be hoped for while *anyone* can call himself an analytical chemist; but if the proposed guild becomes an accomplished fact, I think we should have a good chance of exemption.

I see the Attorney-General intends bringing in a jury bill during the current session, so there is no time to be lost if chemists are to benefit by it.

It appears to me that the necessary nucleus of the proposed guild already exists in the Society of Public Analysts; of course, I do not intend to assert that all members of that Society are fit to become members of the guild. The Public Analysts' Society was originally formed to discuss and influence the proposed legislation on Adulteration, and admirably it has answered its purpose. It is well known that the Public Analysts under the Sale of Food Act are many of them quite unused to general analytical work, and would never desire or expect to be recognised as members of a Guild of qualified Analytical Chemists. Still, the Public Analysts' Society, now numbers either among its honorary or its ordinary members, nearly all the consulting analytical chemists in the Kingdom, and if it were to take in hand the work of formation of a Guild of Professional Chemists, those analysts who are not yet enrolled as members would probably give it their influence and support.

Dr. Wright's proposal of a committee of leading analysts to whom all claims for admission as original members of the Guild should be referred, is, I think, an exceedingly good one. There would be no difficulty in finding half-a-dozen chemists whose decision would give general satisfaction, and I hope we may see something of the kind done without more delay.

Unfortunately, we provincial chemists are too isolated to afford much active assistance in such matters, though we are probably the greatest sufferers; but if the metropolitan analysts will only take the matter up, I think they may rely on receiving the hearty support, both moral and pecuniary, of their brother chemists throughout the country.

Now is certainly the time for action, and the proposal of a corporation of analytical chemists is perhaps more likely to receive the support of a Conservative than of a Liberal Ministry; but while there is a Lyon Playfair in Parliament the interests of chemists are sure to be efficiently represented.

ALFRED H. ALLEN.

Sheffield, February 21, 1876.

SPRENGEL'S WATER-VACUUM PUMP.

To the Editor of the Chemical News.

SIR,—Mr. Thomson (*vide* CHEM. NEWS, vol. xxxiii., p. 73) should not feel any doubt as to the advisability of replying to a letter in a public journal simply because it is anonymous. If he can impugn my statements it matters not if I can sign myself the President of the Society. If, on the other hand, my argument is not refutable, it will not be weakened by having attached to it the name of the merest tyro in science.

Whatever idea Mr. Thomson *wished* to convey by the expression "Bunsen's vacuum pump," the effect produced on the mind of the general reader is that Bunsen was the inventor of the water-vacuum pump, which is simply not the fact. In support of this assertion I think I have already adduced sufficient proof. I may, however, add that in nearly every case in which mercury is mentioned in Sprengel's paper he adds "or any other liquid. He also gives the mathematical data for calculating the proportions of the pump when water is employed. He has since told us that he preferred mercury as the most suitable of the two liquids for *exhibiting* the truth which he had *discovered* by means of a water-air pump in 1863.

Mr. Thomson says the history of this matter is well known to every chemist. Herein I must differ from him, for I cannot believe that, if it were so, such misrepresentation would occur. If Mr. Thomson knows more than has been furnished by Sprengel and Bunsen let him tell us what it is. Till he does so I must believe Sprengel and Bunsen's statement (*Philosophical Magazine*, February, 1873).—I am, &c.,

F.C.S.

SODIUM AMALGAM.

To the Editor of the Chemical News.

SIR,—Were one to judge from the writings of practical chemists (and by way of example I may take the wide range afforded by Roscoe's "Primer" to the excellent paper in the CHEMICAL NEWS, vol. xxxiii., pp. 47, 58, by Dr. Davy "On the Detection of Arsenic") the preparation of sodium amalgam is not an easy, and may be a dangerous process. The proper *modus operandi* is certainly not original with me (I think I saw it many years ago in the CHEMICAL NEWS), but as it would seem to need recalling, and as I have always used it with much comfort, I think it not inopportune to describe it.

Melt the sodium under solid paraffin, then pour in the mercury in a thin stream. Of course any quantity of mercury may be used from equivalent proportion to that necessary for the production of a fluid amalgam. There

is no spirting, and no explosion, no incandescence even, and therefore no need, as Prof. Roscoe directs, to "always take as much as five times by bulk as much mercury as sodium, and less still to "keep the face away" as Dr. Davy advises. In short, if this simple method be adopted, a few grammes of sodium amalgam are as easily made as are no doubt the many kilogrammes manufactured for well known industrial demands. If the quantity of mercury used be such as to produce a solid amalgam, this will solidify before the paraffin, which is to be poured off, and the amalgam cleaned from it with petroleum ether.—I am, &c.,

HARRY NAPIER DRAPER.

WATER ANALYSIS.

To the Editor of the Chemical News.

SIR,—As some of your readers who may have looked at the account of the recent proceedings at the Chemical Society may surmise, the report of what I said in the discussion on water analysis is in various respects inaccurate. I hope, however, shortly to place in proper form before chemists my rejoinder to Dr. Frankland.—I am, &c.,

J. ALFRED WANKLYN.

Laboratory, 117, Charlotte Street, Fitzroy Square, London, February 29, 1876.

ADULTERATION OF MILK.

To the Editor of the Chemical News.

SIR,—A case was reported in the *Standard* the other day of a man brought up at the Thames Police Court for selling adulterated milk. The Analyst stated that the milk contained :—

"Solids, not fat..	5·38
Solids, fat	2·40
	7·78

The amount of water added was 22½ per cent."

If called upon to give an opinion in such a case, would not a man be justified in saying the milk contained nearly twice as much added water as stated by the Analyst?—I am, &c.,

CHEMIST.

London, February 29, 1876.

CONCENTRATING SULPHURIC ACID.

To the Editor of the Chemical News.

SIR,—Our attention has been called to a recent notice in (CHEM. NEWS, vol. xxxiii., p. 55) of a system of concentrating sulphuric acid known as "Faure and Kessler's Patent," and as our opinions have been frequently requested, we venture to think that the following remarks may be of interest to many of your readers.

The "patent" claims in question rest mainly upon an adaptation of a leaden dome or hood to open platinum pans, also a leaden refrigerator, and certain arrangements in working such apparatus. Full details as to the validity of the patent (for the plans and use of which a payment or royalty is demanded equal to from 100 to 200 per cent upon the value of the platinum) would occupy too much of your valuable space, but we shall be happy to send full particulars to any of your readers who may apply for them.

The chief point of interest to manufacturers is the relative economic advantage or disadvantage of the old as compared with the pseudo new system, and the following information will enable those who have received Messrs. Faure and Kessler's offers and prices to form their own judgment :—

The present cost of platinum apparatus complete, with platinum dome, head, arm, and cooler, as supplied by us is for—

1 boiler capable of concentrating 2 to 2½ tons	..	£675
2 boilers " "	together 4 to 5 tons	1200
3 " " "	" 7 to 8 tons	1750

The whole cost being for platinum charged at its market value.

As compared with Messrs. Faure and Kessler's system, the cost of the construction of the cumbrous leaden dome, and other lead work, and of the water required for cooling it, is saved; also the great danger of working with lead and water in close proximity with "boiling vitriol," "platinum," and "fire," and the inevitable expense of frequent repairs. The platinum is charged at its market value, and the purchaser has thus as capital always a realisable asset nearly equal to the first cost, instead of paying for the platinum, as he practically does under the F. and R. system (considering it to be the only asset of value), from 50s. to 75s. per ounce. The cooler being of platinum, there is no danger of the acid being contaminated with lead. The consumption of fuel is about the same in each case. In the years 1862 and 1863, this system of working with several small boilers in series was much pressed by us upon the acid manufacturers, but decided preference was given by them to the old form of large single still.

We may mention that we are now carrying out experiments the result of which will, we hope, be shortly to place at the command of acid manufacturers a system of concentration, which will relieve them of a great proportion of the outlay at present necessary for such plant.—We are, &c.,

JOHNSON, MATTHEY, & Co.

Hatton Garden, London, February 29, 1876.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences. No. 6, February 7, 1876.

Chemical Actions Produced by means of Discharges from an Induction Apparatus.—M. Becquerel.—On operating upon various solutions, the apparatus being worked with two and sometimes with four galvanic elements on the chromic acid principle, the author has obtained the reduction of copper, nickel, cobalt, iron, lead, bismuth, antimony, zinc, cadmium, silver, gold, and platinum. He has also produced amalgams of aluminium, magnesium, and other metals.

Metallic Reductions Produced in Capillary Spaces.—M. Becquerel.—It is remarked that electro-capillary apparatus formed with split tubes act only when the two liquids which penetrate into the slit by capillarity come in mutual contact, which does not take place when the glass is too thick.

Formation of Ethers.—M. Berthelot.—Thermochemical researches on the formation of the hydriodic, hydrobromic, and hydrochloric ethers of amylen; on the formation of the nitric ethers of alcohol, glycerin, mannite, and cellulose; the acid sulphuric ethers of the methylic, ethylic, propylic, isopropylic, butylic, and amylic ethers; as also of glycerin, and on the formation of ordinary ether.

New Chlorated Propylen.—M. Reboul.—The author has obtained a chlorated propylen, $CHCl_3$, distinct from that derived from methyl-chloracetol.

Products of the Action of Chloride of Lime upon the Amines.—M. J. Tschermak.—The crude product of the action of chloride of lime upon hydrochlorate of ethylamin must be regarded as a mixture consisting

principally of hypochlorite of ethylamin and of dichlorethylamin.

Difficulties Encountered in the Preparation of Pure Aniline.—M. A. Reinecke.—Reserved for insertion in full.

Bulletin de la Société d'Encouragement pour l'Industrie Nationale. No. 25, January, 1876.

Report Presented by M. Debray on Behalf of the Committee for the Chemical Arts on a Process of Amalgamation for Silvered Mirrors.—M. Lenoir.—Up to 1840 mirrors were silvered exclusively by means of an amalgam of tin—a process most destructive to the workmen employed. An important step was effected by an English chemist, Drayton, who conceived the idea of coating mirrors with a thin layer of silver, obtained by reducing an ammoniacal solution of nitrate of silver by means of highly oxidisable essential oils. This process was subsequently modified by several chemists, but only became really practical when M. Petitjean substituted tartaric acid for the reducing agents formerly employed. The glass to be silvered is laid upon a horizontal cast-iron table heated to 40°. The surface is well cleaned, and solutions of silver and of tartaric acid, suitably diluted, are poured upon it. The liquid, in consequence of a well known effect of capillarity, does not flow over the edges, forming a layer of some m.m. in thickness. In twenty minutes the silver begins to be deposited on the glass, and in an hour and a quarter the process is complete. The liquid is poured off, the glass washed with distilled water, dried, and covered with a varnish to preserve the silver from friction. The advantages are evident. Mercury with its sanitary evils is suppressed; there is a gain in point of cost, as 4 to 5 grms. of silver, costing about 1 franc, suffice for 1 square metre, which, under the old system, would require 700 grms. of tin and the same weight of mercury. A few hours suffice to finish a glass on the new system, whilst the old process required twelve days as a minimum. On the other hand, the glasses thus silvered have a more yellowish tint; portions of the pellicle of silver sometimes become detached, especially if exposed to the direct action of the sun, and despite the protecting varnish the silver is sometimes blackened by sulphuretted hydrogen. M. Lenoir has happily succeeded in overcoming these defects by a process alike simple and free from objections on sanitary grounds. The glass, silvered as above, is washed, and then sprinkled with a dilute solution of the double cyanide of mercury and potassium. The silver displaces a part of the mercury and enters into solution, whilst the rest of the silver forms an amalgam whiter and much more adhesive to glass than pure silver. The transformation is instantaneous. The amount of mercury fixed does not exceed 5 to 6 per cent. The glass thus prepared is free from the yellowish tint of pure silver. It is also less attacked by sulphur vapours and the rays of the sun, in which last respect it is superior to mirrors silvered by the old process.

Bulletin de la Société Chimique de Paris, No. 3, February 5, 1876.

Reclamation with Reference to a Paper on the Formation of Kermes.—M. Terreil.—A reply to a paper by M. Weppen impugning some of the author's results. Terreil maintains that Weppen has not succeeded in preparing pure carbonate of potash, or baryta and strontia, perfectly free from soda.

Metallurgy of Silver in the Moist Way.—A. Guyard (Hugo Tamm).—There exists in the territories of Utah, and around the Great Salt Lake, enormous deposits of spongy silica, evidently deposited from hot water. These silicas are coloured very variously by oxide of lead, oxide of copper, oxides of iron, hydrated and anhydrous, and they present very different aspects accordingly. All, or nearly all, are impregnated with oxide of lead and chloride of silver. Their proportion of silver, which varies from 1 to 10 kilos. per ton, is found to average from 2·3 to 2·5 kilos. on samples taken from large lots. The great quantity of silica which these ores contain, rarely less than 90 per cent, renders them very difficult to treat in the dry way, whence these ores are the despair of the smelters. On the other hand, the argentiferous ores of Utah are scarcely rich enough to bear the expense of carriage to the great industrial centres, and must be utilised upon the spot, where salt, pyrites, manganese, oxides of iron, charcoal, galena, and wood are plentiful. The real difficulty lies in the fact that the chloride of silver of these ores is scarcely soluble in alkaline chlorides and hyposulphites, whilst roasting the ore, either at high or low temperatures, renders it still less soluble. The desired object was effected by means of nascent chlorine. If the following mixture is heated to a boil until all the chlorine has escaped the liquor is decanted, and the residue washed once or twice with hot water (or, better still, in urine), almost all the chloride of silver will be found in the solution, whence it is extracted by precipitation with metallic iron:—

Utah ore, ground	1 part.
Oxide of manganese	1 ,,
Common salt	3½ parts.
Strong muriatic acid	7 ,,

Along with the silver, lead, a little copper, and other minerals are deposited, forming a metallic paste, from which fine silver is extracted by smelting and cupellation. Ores containing 2·5 and 2·3 kilos. per ton yield, in round numbers, 2·4 and 2·2 kilos. after cupellation, showing that practically all the silver is extracted. This loss appears nearly constant whatever is the original percentage of silver, so that there is an advantage in selecting the richest ores. The following method of operating is recommended:—The ore and the salt are first mixed, half the muriatic acid is added, and the mass is boiled. In this manner all the oxide of lead is dissolved, the masses are disintegrated, and the chloride of silver is laid bare. The second half of the muriatic acid is then added, and the manganese is introduced gradually (about one-tenth at a time), permitting all the chlorine to escape before adding a fresh dose. On a large scale the proportions above given will suffice for 2, and even 3 parts of the ore. The author recommends the introduction of the sulphuric acid manufacture, as the residual burnt pyrites always contain gold. Chlorine will also be useful in treating the auriferous antimony found in the regions between Utah and California. The vessels for the treatment of the silver ore should be of wood, slightly charred in the inside, the contents being boiled by a jet of steam.

Analysis of the Residues from the Sodium Manufacture.—A. Guyard (Hugo Tamm).—The mixture for preparing the sodium was—

Crude soda-ash	56·5
Coal	18·5
Coke	10·5
Chalk	14·5
	100·0

This mixture yields as pure a metal as that obtained from pure dry soda. The residue, after exposure for some time to the air, was found to contain—

Soluble matters	35·0
Water	9·0
Carbon	22·0
Carbonate of lime	18·0
Oxysulphide of calcium	
Alumina	
Ash from the coke and oxide of iron from the retort	15·4
	99·4

The soluble matter was found to consist of—

Caustic soda	11·99
Carbonate of soda	44·30
Sulphate of soda	24·10
Sulphite of soda	11·70
Sulphide of sodium	0·45
Chloride of sodium	7·05
Silica	0·20
Alumina	0·30
Lime and potash	traces
	100·00

No hyposulphite of soda was present.

Analysis of Spent Lime from Gas Purifiers.—A. Guyard.—The material in question was obtained from a gas works in London. Column I. gives the author's analysis, and column II. one executed by the late Prof. Graham:—

	I.	II.
Hydrate of lime	15·10	17·72
Carbonate of lime	34·20	14·48
Sulphate of lime	0·25	2·80
Sulphite of lime	1·50	14·57
Sulphide of calcium	6·90	—
Oxysulphide of calcium	3·20	—
Hyposulphite of lime	11·80	12·30
Cyanide of calcium	0·25	—
Sulphide of iron	0·55	—
Free sulphur	4·30	5·14
Silica	1·80	0·71
Alumina	0·70	—
Magnesia	traces	—
Coal-tar and oil	0·25	—
Water	19·20	32·28
	100·00	100·00

From these results it would follow that Graham's sample had been exposed to the air for some time, whilst that of the author was submitted to analysis immediately on its withdrawal from the purifier.

New Method of Producing Sulphurised Ureas.—M. P. Miquel.—Not suitable for abstraction.

Dynamite made up with Nitro-glycerin and Nitrate of Methyl.—M. C. Girard.—A proposal to add 10 per cent of nitrate of methyl to nitro-glycerin before incorporating it with the silica.

Applications of Bromine in Hydro-metallurgy, Assaying, and Technological Chemistry.—R. Wagner.—Of all the metals mercury is the one whose extraction involves the most serious losses. Thus, according to official returns, the losses at Idria, in reverberatory furnaces, reach 48 per cent, and in the best muffle furnaces they amount to 10. In consequence it has been repeatedly proposed to have recourse to the moist way, but the methods suggested have not been found adapted to practical conditions. The author digests the ores of Idria and of Deux Ponts with bromine-water, containing 3 per cent of bromine, or with the solution of bromine in hydrochloric acid, containing 13 per cent. After digesting the cinnabar with an excess of the bromine liquid for a few days the whole is dissolved, as is also any metallic mercury present. From the solution the mercury is thrown down by means of sulphuretted hydrogen, and the sulphide of mercury is dried and decomposed. The amount of bromine required is very considerable—for 1 part of mercury obtained 3½ parts of hydrobromic acid remaining in solution. The process is therefore only applicable where the manufacture of bromine compounds can be combined with the extraction of mercury. The attack of cinnabar by bromine is an excellent method of analysing this mineral.

Refining Gold.—Gold is readily dissolved by bromine, and the bromide of gold is resolved by heat into metallic gold and free bromine. It is therefore a valuable agent for freeing gold from foreign metals (lead, bismuth, antimony, and tellurium), which alter its properties; all that is necessary is to add to the gold a certain quantity of bromide of gold. The author thinks that it may advantageously replace chlorine in the process of refining devised by Miller, and in Plattner's process for extracting gold, especially applicable to the residues from roasting auriferous pyrites.

Extraction of Platinum.—The action of aqua regia upon platinum ores being very slow, a mixture of bromine or hydrobromic acid with nitric acid is recommended as preferable. A simple solution of bromine has no action upon metallic platinum. Bromine completely converts ferrocyanide into ferricyanide without, like chlorine, giving rise to secondary products. It also transforms manganate of potash into permanganate, and arsenious acid into arsenic.

Presence of Bromoform in Commercial Bromine.—M. S. Reymann.—The author finds bromoform present in certain samples to the extent of 10 per cent.

Les Mondes, Revue Hebdomadaire des Sciences, No. 6, February 10, 1876.

Nickel Mines of New Caledonia.—A controversy having arisen in Australia on the priority of discovery of the nickel deposits of New Caledonia, the Rev. W. B. Clarke, geologist to the Colony of New South Wales, gave a history of the discovery before the Royal Society of Sydney. He showed plainly that the nickel was first discovered by M. Jules Garnier in his exploring expedition undertaken under the auspices of the French Colonial Office. Mr. Clarke has had in his collection, since 1864, specimens of nickel ore sent him by M. Garnier, who, on his return to France, made known the abundant existence of nickel in the island. Mr. Clarke transmitted an account of the discovery to the celebrated mineralogist Dana, who described this ore of nickel as a new mineral species, in the most recent edition of his well-known work. Prof. Liversidge, of the University of Sydney, also described the new substance in a learned memoir. Clarke, Dana, and Liversidge gave the name of Garnierite to this new ore, in honour of its discoverer. The great rise in the price of nickel has latterly drawn the attention of manufacturers to these deposits. The serpentines, and generally speaking all the rocks which accompany them, are often covered with a fine green coating—a silicate of alumina, nickel, and magnesia. The price of the metal is now 40 francs per kilo., and the demand is still increasing. Hitherto it has been extracted from speiss, in which it occurs combined with sulphur, arsenic, antimony, cobalt, &c. With the ore of New Caledonia the extraction of the metal will be simpler and the product less impure, the nickel being here combined merely with earthy matters, as shown in the subjoined analyses:—

Gangue	39·40	3·00
Silica	28·60	41·00
Alumina and ferric oxide	0·60	0·60
Oxide of nickel	12·60	19·00
Magnesia	11·40	16·30
Lime	traces	—
Water	7·50	20·00
	99·90	99·90

This new ore, though of a characteristic green, may nevertheless be confounded with carbonate of copper; and perhaps the miner, deceived by this resemblance, may have already met with Garnierite in other countries, and passed it over as a poor ore of copper not worth closer examination. The mines of New Caledonia have already sent to France a ship charged with 500 tons of this mineral.

Gazzetta Chimica Italiana. Anno v., 1875, Fasc. ix., x.

Essence of Cubebs.—A. Oglialoro.—This paper is not suitable for abstraction.

Action of Chloral, Anhydrous and Hydrated, upon Aniline.—D. Amato.—The result of the reaction is a new base, to which the author ascribes the formula—

$$CCl_3CH \begin{matrix} NHC_6H_5 \\ NHC_6H_5 \end{matrix}.$$

Poisonous Nature of the Extract of Dead Bodies (Human).—Prof. A. Moriggia and A. Battistini.—Extracts of dead bodies made with different solvents were given to frogs, either internally or by subcutaneous injection. The effects of the solvent alone were found by a separate series of experiments.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

An improved press for the extraction of the liquid constituents of fruits and other vegetable matters. E. P. H. Vaughan, F.C.S. Chancery Lane, Middlesex. (A communication from A. Blot, Paris.) January 4, 1875.—No. 37. This press is mainly composed of three Archimedean screws of varyingpitch working together, and so aranged in an outer skeleton casing that the material to be treated, fed at one end through a hopper, is subjected to progressively increasing pressure until it reaches the upper end of the apparatus, where the solid residues are expelled, while the liquid constituents escaping through the perforated casings, are collected by a conduit, which carries them to a reservoir of suitable capacity and form.

A new or improved preparation or dressing for stiffening or finishing textile fabrics and materials, and which is also applicable to other useful purposes. J. Scott, King William Street, London. (A communication from H. Gerard, Paris.) January 4, 1875.—No. 38. This invention relates more particularly to the dressing or finishing of textile fabrics and threads or yarns, and consists in the use of fecula starch, the pulp of tuberous and other roots, and farinaceous and amylaceous substances generally treated with caustic alkalies or alkaline salts, for the preparation of a stiffening material or agent for that purpose, and which it is proposed to designate "apparature." This material or agent so prepared is, however, applicable as a substitute for gum, glue, or other adhesive material, as a thickening agent in printing fabrics, for the prevention of incrustation in steam boilers, and to a variety of other useful purposes.

Improvements in the construction and working of furnaces for the production of iron, steel, and ferro-manganese, and in processes connected therewith. C. W. Siemens, Queen Anne's Gate, Westminster, Middlesex. January 5, 1875.—No. 43. This invention relates to lining rotary and other reducing furnaces with blocks of wood, rendered incombustible in some cases by impregnation with metallic salts, and set in refractory mortar; to constructing midfeathers of furnaces with vertical air-flues to keep them cool; to arranging regenerative gas furnaces with pockets between the regenerators for collecting dust carried over by the products of combustion; to mounting steel ingot moulds on a skeleton turntable for facilitating the tapping of the metal; to producing ferro-manganese in a rotative wood-lined furnace; to reducing iron ore in the same; and to the preliminary calcining of the ore with the application of the salt and water vapour for aiding the liberation of phosphorus and sulphur.

Improvements in the manufacture of gas for lighting and heating purposes, and in the apparatus connected therewith. J. Kidd, Martin's Lane, London. (Partly a communication from L. Arnold, New York.) January 7, 1875.—No. 66. The novelty of my invention consists, first, in the manufacture of lighting or heating gases in carbon, then carbureting this gas with hydrocarbon vapour, after which I pass the carbureted gas through a red-hot retort; by this means I make the mixture a fixed incondensible gas of high illuminating power. The second part of my invention consists in a novel arrangement and method of setting the retorts. I connect together two or three horizontal gas retorts, one above another, with only one stand-pipe or gas-outlet leading to the hydraulic main from the combined retorts; when using three retorts the gas from the lower retort must pass over the coal placed in the two upper retorts, or the gas from the upper retort before escaping may be forced downwards over the coal in the lower retorts. All the retorts should be charged with coal and operated in the ordinary way.

Improvements in the preparation of dried yeast, and in purifying and removing the bitter taste from the yeast of beer, ale, and beer, and in apparatus to be used for this purpose. T. Ellis, Fulham Road, Hammersmith, Middlesex. January 10, 1875.—No. 69. This Provisional Specification describes thoroughly drying, &c., yeast, so that it will keep a long time, and in apparatus to be used for this purpose.

Improvements in purifying liquids, in obtaining or preparing the purifying agents, in recovering, treating, and utilising matters contained in such liquids, and also in other wastes or by-products of manufacturers, and in means or apparatus employed therefor. G. Mackay, Edinburgh, Midlothian, North Britain. January 11, 1875.—No. 91. The features of novelty which constitute this invention are purifying liquids by a solution of per-salt of iron (with or without the addition of sub-salts) and alkali or alkaline earth, utilising the impurities precipitated from the liquids, as well as other waste or by-products, and obtaining a per-salt of iron.

Improvements in means and apparatus for producing or manufacturing iron, steel, and other metals. W. A. Lyttle, Hammersmith, Middlesex. January 12, 1874.—No. 105. The features of novelty are as follows:—First. The applying to copper, zinc, tin, antimony, and other metals the principle followed in manufacturing iron from crushed or powdered ore interm ed with powdered fuel and fluxes, each intermixed ingredient being consolidated into lumps in accordance with my various Letters Patent of last year for improvements in the smelting of iron. Second. Applying to the above-mentioned and other metals the use of the same principle of dealing with powdered and consolidated ingredients without fusion or smelting, in accordance with the principle laid down in the Specification of my Letters Patent, numbered 2581 of 1874. Third. The use of a peculiar aërating apparatus as the means of refining the various metals smelted by this process, and also of converting the reduced or smelted iron made by this process into malleable merchant iron or steel. Fourth. The use of powdered iron produced by this process as the means of reducing or smelting the ores, oxides, sulphides, or chlorides of various other metals, with or without the admixture of carbonaceous matter.

An improved disinfecting fluid. B. F. Weatherdon, Chancery Lane, Middlesex. (A communication from W. Vigné, aîné, Agen, Department Lot et Garonne, France.) January 12, 1875.—No. 107. This invention consists of a disinfecting liquid formed of sulphate of zinc, acetate of copper, phenic acid, and crystals of baryta.

Improvements in cement. J. C. Sellars, Birkenhead, Chester. January 12, 1875.—No. 112. The kind or class of cement to which this invention relates is that employed for repairing, coating, lining, and setting gas retorts, and other vessels and structures subjected to heat, and is now well known as Sellar's plastic cement. A good quality is produced by mixing siliceous sand and silicate of soda or potash. An excellent quality is produced by mixing siliceous sand, sulphate of baryta, and silicate of soda or potash.

Improvements in aerated liquors. R. R. Holmes, Windsor, Berks. January 13, 1875.—No. 122. This invention relates to a mixture of aerated liquors with spirits in the same bottle, so that one decanting serves to give the mixed drink of the required proportion and quality.

Improvements in preparing certain materials employed in printing and dyeing cotton fabrics and yarns. F. A. Gatty, Accrington, Lancaster. January 13, 1875.—No. 124. My improvements consist in preparing oxidised fatty acids by treating soap or other alkaline compounds of fatty acids with chloride of lime.

MEETINGS FOR THE WEEK.

MONDAY, 6th.—Medical, 8.
— London Institution, 5.
— Royal Institution, 2. General Monthly Meeting.
— Society of Arts, 8. Cantor Lectures. "Wool Dyeing," by George Jarmain.

TUESDAY, 7th.—Civil Engineers, 8.
— Zoological, 8.30.
— Royal Institution, 3. "On the Classification of the Vertebrated Animals," by Prof. Garrod.

WEDNESDAY, 8th.—Society of Arts, 8. "Hall-Marking of Jewellery," by Alfred Lutschaunig.
— Geological, 8.

THURSDAY, 9th.—Royal, 8.30.
— Royal Institution, 3. "On the Chemistry of the Non-Metallic Elements," by Prof. Gladstone.
— London Institution, 7.

FRIDAY, 10th.—Royal Institution, 9. "Extinct Animals of North America," by Prof. W. H. Flower.
— Society of Arts, 8. "The Manufacture of Citric and Tartaric Acids," by Robert Warington, F.C.S.
— Astronomical, 8.
— Quekett Microscopical Club, 8.

SATURDAY, 4th.—Royal Institution, 3. "Human Senses," by Prof. Robertson.
— Physical, 3.

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Vanadium in Dyeing and Calico Printing—On the Dip-blue Styles of Calico Prints—Kolb on Linen Bleaching—Upon the Former and Present State of Engraving for Industrial Purposes in the Neighbourhood of Rouen—Wool and Silk Dyeing at the Gobelins in 1847—Upon the Action of Acids in Dyeing with the Colouring Matters of Madder, or its Artificial Substitutes—Critical and Historical Notes concerning the Production of Adrianople or Turkey Red, and the Theory of this Colour—Proceedings of Societies—British and Foreign Patents, from the Commissioners of Patents Journal, January 21st to February 13th, 1876—Supplement: The Practice and Principles of Calico Printing, Bleaching, Dyeing, &c., by Charles O'Neill. Bleaching—Printing (continued).

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THE CHEMICAL NEWS.

VOL. XXXII. No. 850.

ON THE

TREATMENT OF FILTERED ANTHRACEN OIL.

By A. McDONALD GRAHAM, F.C.S.

THE treatment of the oil filtered from the deposited anthracen presents some difficulties, principally from the fact that the anthracen yielded on a second operation is generally so impure as to be unsaleable.

Many small manufacturers prefer to sell the oil without treatment rather than be at the trouble and expense of separating the anthracen, and by others it is frequently allowed to accumulate to an inconvenient degree. I have at times observed large quantities of this oil, in the yards of some manufacturers, placed in casks, waiting either for a favourable sale or a convenient time for operating upon it.

Without pretending to have entirely solved the problem of its successful treatment, in a commercial and economic point of view, I may yet be allowed to throw out some suggestions, which may perhaps lead to a response from some one of your numerous readers, and thus be the means of affording additional light on a subject of some importance to manufacturers.

At present I believe there are two methods of extracting the anthracen from the filtered oil employed by tar distillers. One of these methods consists in subjecting the oil to fractional distillation, retaining only that portion of the distillate coming over between 300° and 360° C. Some manufacturers, however, prefer to re-distil the oil in a cast-iron retort, rejecting the first portions, and continuing the operation until the residue is coked.

As to the first of these methods, viz., purification by fractional distillation, anyone who has made the trial will, I think, agree with me that it is a work of some difficulty and expense, and not to be attempted if an easier method can be found.

The second mode of operating on the oil, viz., distilling to a coke, has the merit of extracting all the anthracen, and was, I believe, in general use by tar distillers when the anthracen was sold by the petroleum and bisulphide test. The quantity of real anthracen contained in the distillate of course varies according to the nature of the oil operated on; but it is usually very small, amounting on an average to about 12 per cent.

The method which I have found to give good results, and which would I think at once suggest itself to anyone who had had any experience in such matters, is to condense the oil, and allow the residue to cool, and the anthracen to crystallise out as at first. In order to do this I place, say, 1500 gallons of the filtered oil in a wrought-iron still, and distil until crystals of anthracen begin to appear in the distillate on cooling: the distillation is then stopped, and after the temperature of the remainder has become sufficiently reduced I run it out into a tank, and allow the liquid to cool, when the anthracen crystallises out in large quantity. A second and a third condensation can be made if necessary; but I have usually found that the oil was sufficiently exhausted in one operation.

The solid portion deposited in the tank will now be found to contain at least 17 per cent of real anthracen, and will be much easier to treat either by fractional distillation or washing, being comparatively free from hydrocarbons coming over at a higher temperature than anthracen. I have found no difficulty in obtaining 36 per cent anthracen by this method, and others by care may arrive at better results.

Should washing be resorted to, it must not be overlooked that the crystals of all the substances dissolved are deposited according to their solubility in the dissolving medium, and by acting upon a knowledge of this fact the best results may be obtained.

Turnchapel, Plymouth, March 4, 1876.

ON THE DIFFICULTIES MET WITH IN THE PREPARATION OF PURE ANILINE.

By M. A. ROSENSTIEHL.

THE separation of bodies of similar properties often presents considerable difficulties; I have experienced it, in these latter years, in trying to prepare aniline free from pseudo-toluydin. At the time when I discovered this last alkaloid I proved its presence in all anilines, of whatever origin they may be, and especially in that of indigo, which passed then for one of the purest. I indicated also the means of preparing aniline, not giving, with chloride of lime, ether, and acidulated water, the characteristic reaction of pseudo-toluydin. I have since succeeded in increasing the sensibility of this method of testing, and, with its aid, I have still been able to detect the presence of this alkaloid in the same aniline, which then appeared to me pure. I have sought for a proper procedure to remove this little quantity of pseudo-toluydin, so as to obtain a product no longer giving a reaction with my new method. The unexpected difficulties met with form the subject of this note.

To test an aniline I prepare a watery and limpid solution. Dissolving 3·2 grs. in 100 grms. of water, at 17° C., to 10 c.c. of this solution, I add 10 c.c. of chloride of soda (obtained by the double decomposition of liquid chloride of lime of commerce, at 7° Baumé, and a cold saturated solution of carbonate of soda). The proportion of chloride of soda may vary from single to double without inconvenience. The fugitive colouration of Runge immediately manifests itself: I agitate with 10 c.c. of ether, which I preserve; I reject the watery liquid. The ethereal solution is washed with a little water; the washing waters are in their turn agitated with a little ether, which is added to the principal portion; this is then shaken with a little acidulated water. If we had pure pseudo-toluydin or aniline, say prepared from indigo, the acidulated water would take subsequently the violet-red colouration of pseudo-toluydin; but with purified aniline the characteristic reaction is no longer observed: we may say that the colouring matter formed is so weak that it is masked by brown matters and the greenish blue precipitate which the aniline produces.

This acidulated watery solution is now the first matter containing signs of the presence of pseudo-toluydin. It is then shaken several times with small portions of ether, which carry off the brown matters; they are rejected. The watery portion is rendered alkaline by some drops of caustic potash, and agitated with ether, which seizes the colouring matter; the watery portion is rejected, and the ethereal liquid is added to it with a little acidulated water; we agitate it, and let it settle. In the first moments the colouration is not perceived: a slight greenish blue precipitate in suspension hides entirely the violet-rose solution of pseudo-toluydin, but after it has settled some hours this colouration will appear in all its beauty.

The pure aniline which was left from my former experiments was converted into oxalate, and the salt crystallised four times in water, then dissolved in alcohol, from which it was precipitated by ether, in which oxalate of pseudo-toluyin is soluble. This operation was repeated twice, but without success. I have not obtained aniline which did not give the rosy colouration.

Benzine from benzoic acid yielded an aniline with which I obtained very strongly the reaction from pseudo-toluydin.

Fifty grms. of anthranilic acid, well crystallised, were dissolved at 150° to 160° in vacuum; the colourless aniline

was distilled into water; the yield was 60 per cent—calculation requires 60·5 per cent. The splitting up is very definite, and, notwithstanding this, the aniline gave distinctly the reactions of pseudo-toluydin.

Twenty kilos. of crystallised benzine, melting at +4·2°, was melted, congealed, pressed ten times in succession, during the cold weather of the winter 1872-3. The point of melting rose little by little to +5·5° C., at which point it remained stationary. There finally remained 5 kilos. of benzine, which was submitted anew to fractional crystallisation: the mother-liquor and the crystals present the same melting-point. I transformed this benzine into aniline; the oxalate of this base was re-crystallised three times in alcohol, then decomposed by caustic soda. This aniline having still given strongly the reaction of pseudo-toluydin, I made with it several trials to remove the latter. I utilised, in the first place, the solubility of pseudo-toluydin in water, of which 100 parts at 17° dissolve 1·3 parts. By six successive washings the half of the aniline was taken up by the water; what remained gave a reaction, of which the intensity was only half that of the original aniline: it was not possible to pass this limit by new washings. Fractionated saturation with sulphuric acid, followed by distillation in a vacuum, gave no better result.

We know that aniline exposed to air grows brown; if it is then exactly saturated with an acid, there arrives a moment when all the mass is coloured red: this colouration is due to pseudo-rosanilin, which is formed in the cold by slow oxidation of the alkaloids. I have finally used this reaction to get rid of the pseudo-toluydin. After preliminary trials I was obliged to renounce the employment of warm air traversing boiling aniline. I finally stopped at this method of working:—We pour aniline in a flask filled with blotting-paper, so as to wet all the paper, and to offer to the air a great surface of action. This flask, stoppered up, is exposed to the air and to the sun during three months: at the end of this time, during which it was frequently opened and agitated, it is fitted with a connecting tube, placed in an oil-bath, a vacuum is made in it, and the aniline withdrawn by distillation. The paper, after this operation, is sprinkled with acetic acid, and colours quickly to an intense rose (rosanilin). The alkaloid thus treated still gives the reaction of pseudo-toluydin, but very faintly.

To sum up, this investigation has taught me that the repeated crystallisation, in water, alcohol, and ether, of salts of aniline or of matters which serve for its preparation, such as anthranilic acid and benzine, is an insufficient method for separating its homologue. There is only the chemical action of the air which has led to an approximately satisfactory result: from the difficulty of removing pseudo-toluydin we may conclude what it would be to remove toluydin, although its presence has not been shown for want of a sensitive reaction.

All the methods of separation that I have employed are less perfect than the method of analysis. By the substitution of this method for the old one I have discovered pseudo-toluydin where formerly I had inferred its absence, which shows at once that the purity of bodies prepared with the greatest care is only relative. Absolute purity is a limit, driven back without cessation by the perfection of our methods of analysis.—*Comptes Rendus.*

The Fellows of the Chemical Society at the Woolwich Arsenal.—It is scarcely necessary to remind the Fellows of the Chemical Society of the President's invitation to visit the Royal Arsenal on the 14th inst. Under any circumstances an inspection of the various departments of the Arsenal is a treat of no mean order, but the advantage as well as pleasure to be derived from an inspection of forging operations on the largest possible scale, and experiments on detonation, &c., under the guidance of Professor Abel himself can hardly be overestimated. Perhaps the greatest novelty to the visitors will be the firing of the 80-ton gun.

NOTES ON ANIMAL CHARCOAL.

Free Lime and Organic Matter.

By ROBERT FRAZER SMITH.

Many chemists are familiar with the phenomenon of "free lime" in animal charcoal. On calculating out the results of analysis, and portioning out to the acids their due equivalents of bases, there remains in all cases a residue of lime, which has provisionally to be marked free. Of course really caustic lime is never, or at least rarely, present in char, and in very minute quantity. Formerly, and for that matter probably is so still, it was the custom to mark the "phosphates" by difference, in reporting an analysis of char for refinery purposes, as the estimation of phosphoric acid, either in his new char or working stock, is to the sugar-boiler a matter of no moment. Of course, when selling the spent, the manure merchant takes care to inform him of the existence of phosphoric acid; but, as a rule, "phosphates" in sugar-boiling establishments include tricalcic phosphate, free lime, and loss.

On the Continent a very curious result is noticed in the treatment of the charcoal with hydrochloric acid of 2 per cent for the removal of excess of lime:—

1. The weak acid does not remove from the char as much calcic carbonate as is equivalent to the HCl used.
2. In the washings calcic chloride is found equivalent to the original HCl.
3. No phosphoric acid is dissolved out by the hydrochloric acid.

Wagner made an analysis of the dried substance (100° to 120°) obtained from the acid waters of the "fermentation" treatment of char for lime-excess removal, this so-called "fermentation" being simply digestion of the char for six or seven days in 1 per cent HCl. No particulars are given of the amount of sugar left behind previous to the treatment.

Lime	32·60
Chlorine	32·00
Magnesia	2·66
Alkalies	1·10
Organic insoluble	0·42
Inorganic ,,	0·56
Sulphuric acid	traces
Phosphoric ,,	absent.

If we calculate the chlorine out to crystallised calcic chloride there remains an excess of 7·36 per cent of lime, which, according to Wagner, is, as well as the magnesia, combined with acids of the acetic series.

One would expect, judging from theory, that, in presence of excess of calcic carbonate, any phosphate dissolved on the first attack would be re-precipitated as soon as the acid was neutralised; and in practice it is found to be the case.

The following are analyses I have made, among many others, for the purpose of ascertaining if the "free lime" was a constant constituent of all charcoals. The samples were dried at 100°, and the results calculated to dryness:—

	Dried at 200°. I.	II.	III.	IV.
Carbon and organic matter	11·51	7·60	9·57	18·33
Phosphoric acid	35·85	36·87	35·76	34·30
Sulphuric acid	0·09	0·27	0·37	0·33
Carbonic acid	3·54	1·61	0·70	0·40
Sulphur	0·04	0·18	0·21	0·10
Sodium chloride	0·47	0·17	0·16	0·31
Iron	0·18	0·69	0·71	0·41
Magnesia	0·28	0·19	0·08	0·04
Lime	47·34	48·82	45·32	43·62
Insoluble and sand	0·50	3·03	6·25	1·60
	99·80	99·43	99·13	99·44

I. A new char. III. Impalpable dust, from dust-room of char-elevators. II. and IV. Old chars; IV. from a refinery where carbon goes up; II. from one where carbon as steadily decreases.

We may state these results as follows:—

	I.	II.	III.	IV.
Carbon and organic matter	11·51	7·60	9·57	18·33
Tricalcic phosphate	77·17	79·75	77·89	74·72
Magnesic phosphate	0·78	0·53	0·23	0·11
Calcic sulphate	0·15	0·46	0·63	0·56
Calcic carbonate	8·04	3·66	1·59	0·91
Sodic chloride	0·47	0·17	0·16	0·31
Ferrous sulphide	0·11	0·49	0·57	0·27
Ferric oxide	0·16	0·54	0·50	0·34
Lime	0·96	3·36	1·96	2·39
Insoluble and sand	0·50	3·03	6·25	1·40
	99·85	99·59	99·35	99·54

Stammer has promulgated the view, which has met with some approval, viz., that in char, revivified in the ordinary manner and at normal temperatures, there are present organic salts of calcium, soluble in water, still more readily in ammonia. By subjecting char to the latter solvent, evaporating to dryness, calcining the residue, and testing for phosphoric acid, none will be found. The lime which remains is the measure of the organic salts of lime, soluble in ammonia water originally present. The lime found in this way does not equal by a long way the "free lime" shown by analysis, but it is assumed that the balance of lime is present as organic calcium salts, insoluble in water and ammonia. If this is so with normally burned char, it follows that the used char before burning must contain a still greater amount of lime in combination with organic acids. In Wagner's analysis, already given, the amount of organic acid present calculated as acetic is equal to the HCl originally present, which amounted to 1 per cent upon the weight of the char, or say, approximately, 1½ per cent of calcium salt. Any organic acids at all likely to be found in sugar, as the result of lactous, butyrous, acetous, mucous, or vinous fermentations, if it were possible even that all should be going on simultaneously, would be found chiefly in the wash waters during the subsequent rigid washing with hot water to which char is always subjected. Supposing even a portion to be finally retained in the char, when sent to the kiln-head the calcic carbonate would be regenerated on re-burning. On the contrary, we do not find any very appreciable difference, as far as regards calcic carbonate, between kiln-head and burned char.

The following analyses represent—V. Char before burning, over which the proper quantity of faintly acid sugar passed in ordinary working. VI. The same char, in order to secure uniform sampling, burned in a pipe in the combustion furnace, at a low red heat.

	Kiln-head Char. V.	Same Char Burned. VI.
Carbon and volatile matter ..	8·95	8·21
Tricalcic phosphate	80·17	80·31
Magnesic phosphate	0·19	0·21
Calcic carbonate	3·46	3·25
Calcic sulphate	0·61	0·70
Sodic chloride	0·16	0·17
Ferrous sulphide	0·36	0·47
Ferric oxide	0·30	0·34
Lime	3·07	2·97
Insoluble and sand	2·51	2·94
	99·78	99·57

Both chars previous to analysis were dried at 200° C., and the results are calculated to dryness.

A portion of V. was boiled with pure caustic soda and filtered. The filtrate, on being acidified with sulphuric acid and distilled, gave nothing more than traces of volatile acids in the distillate. Of course, after allowing the char to ferment, abundant evidence could be had of the presence of the acids in question.

Instead of the lime being in combination with organic matter, it appears more probable that we have present in many charcoals, if not in all, a proportion of oxygen apatite, $3Ca_3P_2O_8+CaO$, larger or smaller, according to the working age of the char and the treatment it may have been submitted to.

The following table gives the composition of several charcoal phosphates present in chars from various sources, but all excepting XI., which is new, were contained in the working stocks of different sugar-boileries, and their composition deduced from the full analysis of the coal:—

	Oxygen Apatite, $3Ca_3P_2O_8$ +CaO.	$Ca_3P_2O_8$	Wibel's Phosphate, $5Ca_3P_2O_8$ +CaO.	VII.	VIII.	IX.	X.	XI.
Phosphoric acid ..	43·21	45·81	44·7	42·99	43·70	43·92	44·08	45·2
Lime ..	56·79	54·19	55·3	57·01	56·30	56·93	55·92	54·76

XI. is unused char. VII. is known to be the most used of the five; but whether the increase in lime is directly proportioned to the age of the char in all cases, it would be rash to hazard an opinion. As far as we can venture to judge, it would appear likely that where the highest heat is carried on the kilns, other things being equal, and the greatest amount of washing is practised, there the basic lime would increase most rapidly. It is interesting to compare these phosphates with the precipitate obtained in the ancient method of phosphate estimation, viz., by adding NH_3 to an HCl solution of the char.

Phosphoric acid	47·01
Lime	51·12
Ferric oxide	1·71
	99·84

The phosphate $Ca_8P_6O_{23}$, octocalcic, yields—

Phosphoric acid ..	48·74	47·91 } = Precipitated
Lime	51·26	52·09 } phosphates.

The material from which animal charcoal is manufactured, as far as has yet been proved, is, from a chemical standpoint, a *mechanical* mixture of $Ca_3P_2O_8$,$CaCO_3$ and gelatin-producing substances, and these, on subjection to a red-heat, yield tricalcic phosphate, with varying proportions of apatite, the undecomposed chalk, and nitrogenous carbon. Wibel (*Berichte der Deutsch. Chem. Gesellschaft*, vii., 220) has demonstrated that, on igniting pure artificial $Ca_3P_2O_8$, chalk, and casein, in varying proportions, the basic salt $5Ca_3P_2O_8+CaO$ was obtained, which centesimally approaches the char phosphate X. I have given above. This salt is a chemical individual substance, and not a mixture. After ignition of the mixed phosphate, chalk, and casein, on moistening with ammonium carbonate, from 30 to 40 per cent of the original CO_2 was found to be unrestorable. This proves the futility of the proposals now and then made for determining free lime in char by the use of CO_2 solutions. One is justified in concluding that, had Wibel re-ignited his basic phosphate over and over again with organic matter and calcium carbonate, he would have reached oxygen apatite, $3Ca_3P_2O_8+CaO$, and in the continual revivification of charcoal the result is brought about. Aeby (*Scheibler's Zeitschrift für Ruben Zucker*, &c., Jahrg. 1873, s. 57) has tried to demonstrate that the earthy matter of bones consists of this basic salt ($3Ca_3P_2O_8+CaO$). If such is the fact we ought to find it in the fresh animal charcoal, and every time it passed through the kiln a certain amount of phosphate still more basic should result. But we find instead that the phosphate in coal from the retorts only varies 0·57 per cent from the normal, if $Ca_3P_2O_8$ is to be regarded as such,—*i.e.*, 16 per cent of the original CO_2 present in the bones is expelled from the chalk, and the lime to which it belonged is linked on to the phosphates,

and after perhaps a hundred ignitions it has not reached further on the way to greater basicity than the apatite stage.

Warington (*Journ. Chem. Soc.*, 1873, xi., 983) has found that the continued action, for two or three hours, of boiling water on gelatinous tricalcic phosphate yields oxygen apatite. Cold water has the same effect, only the time required is immensely lengthened. Whether the basic lime of old char may in any degree arise in a similar way is at present unknown. If one boils a portion of new char in a flask with inverted condenser for twenty-four hours the cellular structure is partially disintegrated, and the pores choked with gelatinous matters. Four samples of new chars were boiled in water some hours, the filtrate collected, evaporated, and the phosphoric acid determined. They yielded 0·061, 0·043, 0·034, 0·043 per cent on the char, and the acid appeared chiefly combined with magnesium. Five grms. of char (VII.) were boiled twelve hours with 100 c.c. of water, and filtered. The filtrate contained 0·206 per cent of lime (on the char), and 0·04 per cent of phosphoric acid. On the basic phosphate the action appears reversed. Further experiments are in progress on the action of water on chars.

We now know that the charcoal in the act of production acquires so much basic lime, and the igneous action is quite capable of giving birth to all the subsequent additions to the initial amount without calling upon the aqueous method for assistance.

The presence of organic matter is apparently helpful to the apatite formation, and in "kiln-head char" which has been thoroughly washed the amount of such matter insoluble in acids is sufficiently large. The following carbon determinations of the same char before and after burning will show this. The samples were taken on different occasions:—

Before.	After.	Difference.
10·11	9·66	0·45
10·14	9·45	0·69
10·65	9·72	0·93
10·37	9·88	0·49
9·98	9·49	0·49
10·55	9·62	0·93
10·43	9·72	0·71

Of course this difference must vary according to the quality of the sugar manipulated and the general mode of working. From what is known in the meantime the hypothesis of Stammer has no solid foundation, but I propose to continue the investigation by making various organic analyses of animal charcoals. It would indeed be strange if any acid should be present capable of resisting (and increasing in spite of) frequent heatings to 800° F., and, though unestimated, showing no loss from deficiency equal to what would be necessary.

Divis (*Chem. Centralblatt*, 1873, 311; *Journ. Chem. Soc.*, xxvii., 709) gives a process for estimating "caustic lime" in char. A weighed amount, boiled with NH_4Cl solution and the evolved NH_3, passed into standard acid. A char was taken containing no caustic lime, but 2·5 per cent basic lime, and tested carefully by Divis's process. The ammonia evolved was equivalent to 0·504 per cent of lime. As might be anticipated, the process is worthless. If anyone would discover a method by which uncombined or basic lime in char could be reliably and quickly estimated he would render a service, by solving a difficult chemical problem.

ENCROACHMENTS ON THE CHEMICAL PROFESSION.

A FRESH instance of the encroachments referred to in our last issue has occurred in connection with the proposed removal of the Mint to the Savoy. The Government has employed Mr. F. J. Bramwell, an engineer, to report on the possibility of the Mint proving a nuisance to the neighbourhood. Now, as the nuisance, if any should arise, must depend on the escape of fumes and gases, the question is strictly chemical, and can no more be solved by an engineer than by a lawyer or a clergyman. We are glad to find that this opinion was expressed by one of the speakers at a meeting held in the vestry-room of St. Mary-le-Strand to protest against the New Mint. "Mr. Bramwell" it was remarked "was a civil engineer and not a chemist, and his opinions, therefore, on the fumes which would arise from the melting of the metals could not be worth much." An evening paper, discussing the question, makes the farcial suggestion that if Mr. Bramwell's report is not considered satisfactory "some other eminent engineer" ought to be consulted.

THE "EAGLEY EPIDEMIC."

THIS strange outbreak of fever has occasioned no small amount of controversy in the local papers. The analyses of Mr. E. Sergeant, Public Analyst to the Borough of Bolton, and of Mr. Pattison Muir, of Owens College, Manchester, both show that the suspected milk is abnormally poor, as if diluted with water. But Mr. Muir remarks, very justly, that it is impossible to say, from the results of chemical analysis, whether milk is contaminated with disease germs or not. The water from the farm of Mrs. Kershaw, at Eagley, which it is thought may have found its way into the milk, is reported by Mr. Sergeant to contain 0·26 part of albuminoid ammonia in a million. This is nearly as bad as unfiltered Thames water, taken above Hampton Court, in which 0·28 part of albuminoid ammonia per million were found by Messrs. Wanklyn and Chapman. Of course in water chemical analysis can show merely the total amount of foreign matter present, without indicating how much, if any, of it consists of the germs of disease. Mr. Sergeant's analysis is called in question by Mr. Watson, who doubts that 9 grs. of chlorine could be present in a water yielding only 13·5 grs. of total solids. It is extremely desirable that further light should be thrown upon this case. It is to very little purpose that we insist upon a pure water supply for our cities, if fever-poison may be swallowed in the shape of milk. The village of Eagley itself is said to be plentifully supplied with good water. A Government enquiry is promised, but unfortunately in cases of this kind so much time elapses before suspicion is aroused, that the most valuable evidence is no longer to be obtained.

ON CERTAIN CIRCUMSTANCES WHICH AFFECT THE PURITY OF WATER SUPPLIED FOR DOMESTIC PURPOSES.*

By M. M. PATTISON MUIR, F.R.S.E.,
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WATER as supplied for domestic use may suffer contamination from various sources. Those which I propose to consider are—(1) The metallic pipes through which the water flows, and the metallic vessels in which it may be stored; (2) Certain of the metallic vessels through which the water may pass during various domestic processes; and (3) The existence of cisterns inside the house in which the water may be stored before it is used.

The metals which are most commonly employed in the formation of water pipes, or of vessels in which water is kept, are lead and copper; these metals exert, as is well known, a poisonous action upon the human organism.

It is known that water exerts a certain solvent action upon these metals, and that this action varies in accord-

* A Paper read before the Manchester Literary and Philosophical Society.

TABLE A.

Lead Dissolved by Water Containing Various Salts in Solution.

Salt.	Mgms. per litre.	Grains per gall.	Lead Dissolved. In Mgms. per Litre. After 24 hrs.	48 hrs.	72 hrs.	In Grains per Gallon. 24 hrs.	48 hrs.	72 hrs.
Ammonium nitrate	20	1·4	13·0	—	25·0	0·91	—	1·750
,,	40	2·8	15·0	15·0	32·0	1·05	1·05	2·240
,,	80	5·6	15·0	—	—	1·05	—	—
Potassium nitrate and Sodium sulphate	20 and 50	1·4 and 3·5	2·0	2·0	—	0·14	0·14	—
Potassium nitrate and Sodium sulphate	40 and 212	2·8 and 14·7	0·8	1·0	1·2	0·05	0·07	0·080
Potassium nitrate and Potass. carbonate	45 and 305	3·1 and 21·5	—	—	0·3	—	—	0·021
Potassium nitrate and Potass. sulphate	70 and 504	5·4 and 35·2	—	—	0·5	—	—	0·035
Calcium sulphate	252	17·5	0·4	—	0·8	0·02	—	0·050
,,	408	28·5	0·4	—	1·0	0·02	—	0·070
Potass. Carbonate	310	21·7	—	—	0·2	—	—	0·014
,,	516	36·1	—	—	0·2	—	—	0·014
Calcium chloride	250	17·5	0·5	0·5	0·5	0·04	0·04	0·040
,,	510	35·7	0·3	—	0·4	0·02	—	0·028
Sodium sulphate	200	14·0	—	—	0·8	—	—	0·050
,,	400	28·0	—	—	0·5	—	—	0·030
Ammonium nitrate and Calcium chloride	20 and 60	1·4 and 4·2	—	—	1·8	—	—	0·126
Ammonium nitrate, Potass. carbonate, and Sodium sulphate	20 100 and 200	1·4 7·0 and 14·0	—	—	0·4	—	—	0·028
Sodium sulphate, Potass. carbonate, and Calcium chloride	200 40 and 100	14·0 2·8 and 7·0	—	—	0·1	—	—	0·007
Loch Katrine water	—	—	1·0	1·0	1·5	0·07	0·07	0·105
Distilled water	—	—	2·0	2·0	3·0	0·15	0·15	0·210

ance with the quality and quantity of the salts held in solution by the water. I have endeavoured to obtain a few definite measurements of this action in regard to (*a*) the nature of the salts in solution, (*b*) the quantity of those salts, and (*c*) the length of time during which the action proceeds.

I. *Action on Lead.*—A number of solutions were made containing a known amount of various salts dissolved in distilled water; pieces of clean bright lead were suspended in these liquids for various lengths of time, and the amount of lead which was dissolved was estimated at certain intervals; the method employed being the colorimetric one described in the CHEMICAL NEWS, vol, xxxiii., p. 11. The salts employed, the amounts of each, and the amount of lead dissolved after 24, 48, and 72 hours' action are stated in the following table in m.grms. per litre and in grs. per gallon. The surface of lead exposed measured 5600 sq. m.m.

From the table it is evident that the salts enumerated have, when in solution, very different actions upon lead. Nitrates undoubtedly very largely increase the solvent action of water upon lead; the other salts generally diminish this action.

The general conclusion which I would draw from these results are:—

(1.) *Nitrates* if present alone even in small quantity cause water to exert a very marked solvent action upon lead.

(2.) The presence of other salts—*sulphates*, *carbonates*, and *chlorides*—*along with nitrates*, greatly decreases, or even stops, this solvent action; carbonates especially exercise a deterrent action.

(3.) *Carbonates*, *sulphates*, and *chlorides*, when added to distilled water, greatly diminish the solvent action of that water upon lead.

(4.) A small quantity—about 15 grs. per gallon—of these last-mentioned salts exercises almost as great a deterrent action as a comparatively large quantity, about 35 grs. per gallon.

(5.) The amount of lead dissolved increases but slightly after the lapse of twenty-four hours in the presence of these salts which exercise a deterrent action upon the solvent power of water on lead. In the presence of salts which increase this action—notably of nitrates—the amount of lead dissolved increases with the length of time during which the water remains in contact with the lead. I cannot speak with certainty upon this point for a greater length of time than 72 hours.

In these experiments the lead was uniformly clean and bright. Inasmuch as natural waters, even if contaminated with nitrates, usually contain small quantities of soluble carbonates, sulphates, or chlorides, the solvent action of these waters upon leaden pipes and leaden cisterns may, I think, be said to be, under ordinary circumstances, exceedingly small. I would especially draw attention to the experiment made with water containing 1·4 grs. of ammonium nitrate and 42 grs. of calcium chloride per gallon; the amount of lead dissolved after 72 hours being only 0·126 grs. per gallon, whereas water containing the same amount of ammonium nitrate, but without the addition of any other salt, dissolved 1·75 grs. per gallon, or about fifteen times as much lead in the same time. As a water which contains nitrates very often also contains chlorides this reaction is one of some importance.

Under certain circumstances there can be no doubt that water will dissolve considerable quantities of lead, this is

especially the case with water charged with carbon dioxide, and with hot water.

Dr. Roscoe has described a case in which a leaden cistern was very quickly acted upon by hot water.*

(To be continued.)

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, March 2nd, 1876.

Professor Abel, F.R.S., President, in the Chair.

After the minutes of the previous meeting had been read and confirmed, Messrs. T. Bertram Udall and J. C. Gamble were nominated, and Messrs. Albert B. Prescott, M.D., and Nathaniel Bradley were elected Fellows of the Society after their names had been read the third time.

The President said he had now to invite the Fellows of the Society and the visitors to resume the discussion of Prof. Frankland's paper "*On some Points in the Analysis of Potable Waters.*" At the last meeting he had ventured to point out that there were three points especially to which it would be as well to confine the discussion. These were—First, the direct process for determining the carbon and nitrogen of Messrs. Frankland and Armstrong; secondly, the albuminoid ammonia process of Messrs. Wanklyn, Chapman, and Smith; and, thirdly, the evidence of pre-existing sewage contamination, and its value as affording indications of the wholesomeness of a potable water. Dr. Frankland had had a large experience, extending over many years, in the application of his method; and the diagrams which were exhibited afforded incontestable evidence of its value, showing as they did, not only the relative purity of waters from different sources, and the fluctuations caused by floods, but also the more minute details of the variation in water supplied by different companies from one and the same source, caused by differences in storage, the power of excluding flood-waters, &c. Since the process was first introduced various improvements had been made, which evidently much facilitated and expedited its working, especially in the method of evaporation; but there were one or two points upon which he would like to elicit information. The evaporation to dryness certainly appeared to be a weak point; for although no doubt the carbon and nitrogen in the residue obtained could be most accurately determined, did the residue really contain the whole of the organic matter present in the water? Were there any organic matters, however small in quantity, carried off mechanically or oxidised during the evaporation? The sulphurous acid used in the evaporation process, moreover, must become in part oxidised: did the small quantity of sulphuric acid thus formed cause the destruction or removal of any carbonaceous matter? Again, when nitrates were present, certain precautions were necessary: but had it been proved that the nitrates were entirely removed by the evaporation with sulphurous acid, even with the addition of ferric chloride? Dr. Frankland had published certain results, in which organic matter of known composition had been added to pure water, and the amount in the residue determined; but he did not know whether any nitrates were present in these cases, or if so what effect their presence and the consequent treatment of the water had upon the results obtained. With regard to the albuminoid ammonia method, which was very extensively used, and with which he himself had had some experience, although it gave concordant results if uniformly conducted, yet if he were asked, he could not say exactly what it indicated by itself; but taking it in relation with the inorganic constituents and a knowledge of the source, the surroundings, and previous history of the water, &c., it was of value in forming an opinion regarding the wholesomeness of a potable water.

Mr. Wanklyn said that, besides the impracticable character of the "combustion" process of water analysis (to which character the discoverers of the process ascribe its almost universal rejection by chemists), another defect in the process has prevented chemists from resorting to it. This defect may be broadly said to be that whilst the process professes to measure the carbon and nitrogen existing in organic combination in drinking-waters, it fails to make these measurements. This failure follows as a necessary consequence from two of the conditions under which the process is placed. One of these conditions is that before resorting to "combustion," there is an evaporation of the water to dryness, and that destruction of the organic matter occurs during this evaporation. Some of the organic substances present in drinking-water are very perishable, and others doubtless are almost indestructible when exposed for several hours to the action of air and moisture at temperatures not exceeding 100° C. The few milligrms. of organic matter contained by a litre of drinking-waters are, probably in no single instance, preserved absolutely intact in the residue left on evaporating a litre of water down to dryness. In some cases, indeed, not the one-thousandth part of the organic matter originally present in the water will survive the evaporation. If, then, the actual combustion itself were perfectly devoid of experimental error, it follows, as a matter of necessity, that the combustion process of water analysis must sometimes fail to measure $\frac{999}{1000}$ of the carbon and nitrogen existing in organic combination in drinking-water. The second condition under which the "combustion" process of water analysis is placed, and which renders it a failure, is that, owing to the extreme minuteness of the proportion of organic matter in drinking-water, the combustion has to be made on too small a scale. Instead of burning the quantity of organic matter which chemists are accustomed to employ (viz., from 0·1 to 0·5 grms.), the operator burns only a few milligrms. when he practises the Frankland process. Unless, therefore, the absolute experimental error had been diminished by the modifications of the operation of combustion, it will be acknowledged that the error of experiment is so large as to render illusory the measurement of organic carbon and nitrogen in drinking-water. Has Dr. Frankland diminished the absolute error in combustion? The paper read by Dr. Frankland to this Society in the year 1868, shows that at that date he had *not* diminished it. On that occasion—viz., in the year 1868—having burnt centigrms. of organic substance, whilst chemists usually burn decigrms., he made an absolute error of about $\frac{1}{8}$ of the quantity of carbon operated upon; and (since the usual experimental error is $\frac{1}{10}$) it will be seen that the absolute error remained about the same. The Lecturer has alleged that the accuracy of the process has been increased since 1868, and in the appendix to the last Report of the Rivers' Commission, *vide* page 505, three experiments on sulphate of quinine are published in support of that assertion. A correspondence published in the Chemical News sheds light on the character of these experiments, and I presume that the majority of chemists will not place implicit confidence in them. To those chemists (if any such there be) who are convinced by the quinine experiments, and who believe that the absolute error, which was 0·30 milligrm. of nitrogen in the year 1868, had diminished to 0·01 milligrm. in the year 1873, I would suggest that the curve showing the amount of organic matter in Thames water during the last eight years must surely be the curve expressing the improvement in the Frankland process. And highly interesting it is that this should follow the flow of the River Thames. Passing next to the Lecturer's criticisms of the ammonia process of water analysis, invented by Chapman, Smith, and myself, I will be very brief. The

* Proceedings of the Manchester Literary and Philosophical Society, xiv., p. 23.

statements that "*the actual present organic matter in water can only be ascertained by the estimation of the carbon and nitrogen*," and that "*the albuminoid ammonia process affords no evidence of the absolute quantity either of the organic matter or of organic nitrogen present in potable waters*," are based on a long-exploded fallacy which I believe Liebig once encountered. The fallacy is that the only quantitative operation to which organic compounds can be submitted is the process of elementary analysis into carbonic acid, water, and nitrogen. I will answer it by a parallel. Acetic ether may be made to yield acetic acid quite quantitatively; and in whatever sense the carbon contained by acetic ether can be said to be a measure or index to the acetic ether, in that same sense the acetic acid is a measure or index to the acetic ether. An unknown mixture of acetates could not be absolutely measured by the carbon it contains, neither could the mixture be absolutely measured by the acetic acid which it gives. But in whatever sense the carbon can be said to be an approximate measure of the mixed acetates, in that same sense is the acetic acid a measure. For acetic acid read albuminoid ammonia, for acetic ether read albuminous substances, and for mixed acetates read the miscellaneous nitrogenous organic matters in drinking-water, and the parallel is complete. To the Lecturer's objection that there are nitrogenous organic substances which yield no albuminoid ammonia, I answer that urea is the only one which is likely to occur in drinking-water, and urea is fully provided for by the ammonia process. If, perchance, a trace of nitro-compound ever make its way into drinking-water it would not be detected by the ammonia process. But that is no objection to the ammonia process, which is designed to measure the albuminoid substances and miscellaneous nitrogenous *débris* in water, and which is all the more valuable for not confounding nitro-compounds with them. The Lecturer's assertion that my colleagues and I "declared the waters of Bala Lake, and that supplied to Manchester from the Derbyshire hills to be no purer than Thames water," is a very curious misrepresentation of what we really do maintain. The passage requires the insertion of the word "filtered," and then would be correct. That filtered water is clean, and that rain-water is sometimes foul, has been taught us by the ammonia process, and is, indeed, consonant with reason. On the subject of pre-existing sewage contamination I need say very little. The cleanest water that is found in nature is loaded with nitrates, the dirtiest is sometimes almost devoid of nitrates, and the same river-water is at one time charged with nitrates, and at another time devoid of nitrates, and suffers no corresponding fluctuation in the sewage poured into it. Knowing this I cannot understand how nitrates can indicate previous sewage contamination, and, as is well known, I systematically disregard them in the ordinary course of water analysis. I am even disposed to look on their presence as evidence that the water which contains them has undergone purification.

Dr. Letheby said he was very sorry that he was unable to be present at the lecture, and after some preliminary observations remarked that as very small quantities of substance were dealt with small errors became of great importance. He thought that during the evaporation of the water the atmospheric oxygen and the oxygen dissolved in the water must destroy a portion of the organic matter. Moreover, in order to get rid of the carbonic acid and nitrates from the residue, sulphurous acid had to be used, which became in part changed into sulphuric acid, so that if too much were produced organic matter would be destroyed, and if too little sulphurous acid were used we should have nitrates present in the residue. Again, in making the combustion, there were practical difficulties, such as the introduction of organic dust from the atmosphere, &c. In fact, so unsatisfactory were the results which his coadjutor, Dr. Tidy, had obtained with it, although he had been to Dr. Frankland's laboratory to learn the process, that they had rejected it. He considered the term pre-existing sewage contamination a very improper expression, a very inexact expression, and very likely to mislead, for the organic nitrogen in water does not necessarily indicate sewage contamination; for instance, the water of the Nile, which in Egypt is considered a very sweet water, contains organic nitrogen, in plenty and abundance of nitrates, and that 400 miles above Cairo. He believed the estimation in which chemical opinions on sanitary subjects was held would be lowered, and much harm done by the general adoption of such an expression.

Dr. Tidy thought it was a pity such a diversity of opinion should exist amongst chemists on the subject of water analysis. He did not think there was much force in the objection to Dr. Frankland's process that it takes much time and trouble; for if it gave accurate results such a question ought never to be raised. But did it give accurate results? He said he had made sixty-eight determinations by the process, and then proceeded to give an account of the results he had obtained with it, from which it appeared that in sixteen cases out of twenty-eight he had obtained nearly double the amount of carbon he ought, and the nitrogen determinations were equally unsatisfactory, although every care had been taken in the evaporation. He had also found great practical difficulty in detaching the residue from the capsule, and in keeping out dust, &c. With regard to the albuminoid process he must express his regret that Mr. Wanklyn had not published an extended list of carefully-collected details of experiments, as he had found not only that the whole of the nitrogen was not obtained, but that the presence of chlorides certainly affected the results. You were told to distil the permanganate solution until ammonia ceased to be given off, but if you then left it for a day, and again distilled, you would again get ammonia, and the next day more. Notwithstanding this, it certainly gave results which had some relation to the amount of deleterious impurity present. A potable water, however, should be judged rather from a broad view of the whole of the results of the analysis.

Dr. Russell said that after the display of oratory they had just heard he felt some diffidence in speaking, but his excuse must be that he had some little experience both with Dr. Frankland's and with Mr. Wanklyn's methods. There certainly were difficulties of manipulation attached to the former process, amongst which he might mention the obtaining pure copper oxide, and the assaying of it; but if the operations were carefully performed, accurate results would be obtained, although inconveniently large errors of observation might occur. The necessity of setting up a complicated apparatus militated against its use in laboratories where water analysis was only occasionally performed. The albuminoid ammonia process had come into general use from its comparative simplicity; the results obtained by it, however, should never be taken alone, but in conjunction with the amount of the chlorides and the remainder of the analysis, and the same might also be said of Dr. Frankland's process, for the question put to chemists practically amounted to this—Is this water fit for use? He thought the ammonia process the most convenient for general use, but when any special points were to be brought out we should fall back on the "combustion method," which was a most admirable scientific process, and had given us some splendid and instructive information.

Dr. Voelcker would have left no stone unturned to follow out Dr. Frankland's process if he could see what to do with the carbon and nitrogen when he had got it. But if he could do nothing with it, why should he go to so much trouble to ascertain its amount? Moreover, if the amount of carbon and nitrogen present was an indication of the impurity of the water, we should have to reject many waters of a peaty nature which were perfectly wholesome. He had adopted Wanklyn and Chapman's process, not because he considered the results obtained by it as strictly exact, but because it gave extremely useful indications of the purity of a water when taken in conjunction

with the other results of analysis. There was one point which had not been previously noticed, and which he might allude to, and that was the occurrence of notable quantities of phosphoric acid as phosphate of lime in waters which were decidedly unwholesome, generally associated with albumenoid ammonia, chlorides, and alkaline carbonates. If such a water were filtered through a soil the phosphates would be removed, but not if it had merely trickled through fissures in the ground; so that a well-water which contained phosphates might be considered unwholesome and exhibiting actual sewage contamination.

Dr. Bischoff remarked that although the albuminoid ammonia process had the advantage of simplicity of manipulation, it was not, strictly speaking, a quantitative method, and the results obtained by it were often fallacious. The speaker then showed that when examined by this process a pure water mixed with 0·01 per cent of urine would be considered wholesome, and also quoted numbers obtained by two Scotch chemists which were anything but concordant. He had also made experiments with the water of Loch Katrine by Frankland's process, which gave 0·162 carbon and 0·024 nitrogen. On adding variable quantities of nitrates to this, and evaporating, he had obtained the numbers 0·140 C and 0·020 N in one instance, and with a larger proportion of nitrates the numbers 0·170 C and 0·018 N.

Mr. W. Thorp said that in connection with the Rivers' Commission he had had a large experience in the matter of water analysis, having collated the results of many thousands of determinations made by himself and three or four colleagues. He had been rather amused at the doleful description of the difficulties of the process given by some of the speakers; for instance, the removing the water residue from the capsule. This he could say had never been felt at the laboratory of the Rivers' Commission, except in a few instances where the water was contaminated with some factory products. The combustion process does what no other process does, and that is, gives the relative proportion of carbon and nitrogen. This ratio is of the utmost importance in forming an opinion on the nature of a water. With regard to the term previous sewage contamination, most of the mistakes arose from a misunderstanding of plain English, by confounding it with actual or *present* sewage contamination. In order to overcome this difficulty, however, he would propose to use instead "mineral combined nitrogen," or, more shortly, "mineral nitrogen," and would recommend that instead of reporting the nitrogen as ammonia it should be given as nitrogen present as ammonia.

Dr. Armstrong said he would like to make a few remarks on the sources of error in the combustion process. The loss by evaporation had been much exaggerated. As now performed, under a glass shade, in a reducing atmosphere containing sulphurous acid, oxidation would be reduced to a minimum, and Pasteur has shown that, on exposure to the air of organic matters, but little action took place at the ordinary temperature, even in three years; the absorption of oxygen which usually takes place being due to the presence of living organisms. At the high temperature of the water during the evaporation this cause could not operate. Again, as far as our knowledge of the splitting up of albuminoids under the influence of dilute acids extends, they appear to yield bodies even more stable than the original substances, and therefore not likely to be affected by the evaporation.

Dr. Dupré made some remarks on the indications given by the albuminoid process, pointing out that there was no difficulty in determining by it whether a water was bad, but whether a water which is nearly pure is wholesome or not. He considered that good results could be obtained by the ammonia process when fairly worked.

Mr. Friswell said as far as his experience went it was difficult to obtain good results when a very bad water was treated by the ammonia process, and illustrated his remarks by the abnormal results obtained with an effluent water he had examined, to which—

Mr. Wanklyn replied that the ammonia process was not properly worked unless the water was completely exhausted, and where time was an object it was advisable to operate on a comparatively small quantity when the water was of this character. One of the merits of the ammonia process was that it concentrated the ammonia, and thus rendered evident very minute quantities of albuminoid substances.

Dr. Frankland, in replying to the various speakers, said he would make his remarks as brief as possible. With regard to Mr. Wanklyn's objection to the process on account of the difficulties of manipulation, he was afraid he still belonged to the number of those who had not tried it, and whose objections were purely theoretical, for he seemed to imagine that the errors incident to the determination were the same in amount as those of an ordinary combustion, but this was not the case. In the original paper, where the determinations were made with comparatively large quantities of organic matters, the error was found to be about 1-20th, and although even this was of no moment in forming an opinion about a water, yet subsequent experiments had shown that this error was not transferred when smaller quantities were operated on. With very small quantities results were now obtained within 1-44th of the whole organic matter present. The comparative error must be looked at in as far as it affects the chemist's opinion of the water. With regard to the possibility of a minute portion of the nitrates escaping destruction in the evaporation of the water, the original experiments of Dr. Armstrong and himself showed that this was not the case, as did also the analysis of certain waters which contained nitrates, but which gave no organic nitrogen on combustion. Moreover, Dr. Bischoff's experiments with the Loch Katrine water proved that the presence of nitrates did not interfere with a correct determination of the organic carbon and nitrogen, a result which may also be deduced from the results of the analyses of the Thames waters—for example, in summer, when the amount of nitrates varies most, the organic elements remain about the same. This the speaker illustrated by the numbers obtained with five of these waters in 1870. In order to obtain some evidence of the extent of the oxidation which might take place during evaporation, he had repeated the sawdust experiment referred to by Mr. Wanklyn at the last lecture, but after passing air over it for two whole days, at a temperature of about 70° C., he had only obtained mere traces of carbonic acid. All the recent experiments on putrefaction tended to show that the development of carbonic acid was due to the presence of germs, and at 70° or 80° C. these germs would be destroyed. Moreover, the organic matter during evaporation would be protected by the sulphurous acid. The amount of ammonia obtained from a water by the albuminoid process had comparatively little bearing on the subject, as it was found that waters, as those of a peaty nature, where you would expect little, gave the largest quantity. Mr. Wanklyn himself had found the Bala Lake to give 0·25, Loch Katrine 0·08, whilst the Thames only gave 0·06, making the Thames water appear the purest. The speaker then proceeded to very strongly criticise Dr. Letheby's remarks, especially alluding to his adherence to the method of estimating the amount of organic impurity present in a water by means of a solution of permanganate, and to his opinion that the evidence of pre-existing sewage contamination was of little or no moment. He would also reply to Dr. Voelcker's observations, that by means of the combustion method, in a very large number of cases at all events we could most positively detect the difference between contamination by vegetableor animal matters, and hoped shortly to bring this important matter before the notice of the Society. After referring to the formation of sulphuric acid from the sulphurous acid during evaporation, and the reasons why he had adopted the term "pre-existing sewage contamination," he concluded by saying he quite agreed with the President that the importance of judging of a water by all its antecedents could scarcely be over-rated.

The meeting was then adjourned until Thursday, March 16, when the following papers will be read:—(1) "Experiments on Crystallised Glycerin," by Dr. van Roos; (2) "Notes on the Fatty Acids, and on a Suggested Application of Photography," by Mr. W. H. Hatcher; (3) "On Stibine," by Mr. F. Jones; (4) "On the Use of Platinum in the Ultimate Analysis of Carbon Compounds," by Mr. F. Kopfer; (5) "Action of Sulphuric Acid on Naphthalene," by Dr. J. Stenhouse and Mr. C. E. Groves; (6) "On the Action of the Organic Acids and their Anhydrides on the Natural Alkaloids," Part V., by Mr. G. H. Beckett and Dr. C. R. A. Wright.

CORRESPONDENCE.

ELECTROLYTIC COLOURATION OF THE SALTS OF ANILINE.

To the Editor of the Chemical News.

Sir,—I have noticed in the Chemical News (vol. xxxiii., p. 78) a translation of a paper from the *Comptes Rendus*, by M. F. Goppelsroeder on the production of green and blue pigmental matter at the positive pole when the salts of aniline are submitted to galvanic action. This fact was observed by me as far back as the year 1862, and it was the subject of a communication by me to the Chemical Society of London on the 20th March, 1862. The paper is published in the *Journal of the Chemical Society*, vol. xv., p. 161 (1862), and it is noticed in the Chemical News, vol. v., p. 178. I mention this for the purpose of showing that the production of this pigmental matter and the account of its leading chemical properties have been known for many years.—I am, &c.,

H. Letheby, M.B., M.S.

Laboratory, London Hospital College,
March 3, 1876.

ORGANISATION AMONG CHEMISTS.

To the Editor of the Chemical News.

Sir,—All chemists who appreciate aright matters affecting the interests of their profession must have welcomed the recent articles on the above subject that have appeared in your journal.

Chemistry is not only "a hard kind of badly renumerated work," but professional men are, under the existing circumstances, classed to-day with quacks who rejoice in the possession of bogus degrees, and to-morrow fees which should come to them are pocketed by men who ruin the title of "chemist" by borrowing it. And yet the remedy for these evils is in our own hands, and it is only necessary to following out some such plan as that so ably indicated by Dr. Wright, to effectually enhance the professional status of chemists.

In commenting on Mr. Allen's letter, you, Sir, have shown the undesirability to take the Society of Public Analysts as the nucleus of the proposed Chemical Guild or Association, and this view I venture to think, will be endorsed by most analytical chemists, for the reasons you have specified.

Further, as Dr. Wright has shown, the Chemical Society occupies very distinct ground from that which should be covered by the proposed guild; therefore, any attempt that should be made to establish such an institution must come from the body of chemists themselves.

While, however, nearly every chemist of any repute could furnish abundant evidence of the evils attending the present non-organised state of the profession from his own history, it is matter of wonder that no steps have been taken hitherto to cure these evils.

To successfully work out such a scheme as that developed by Dr. Wright requires unity of strength and energy of character on the part of those who undertake it, and it becomes chemists to amiably join hands in the work, and to forget those differences which exist between many of them (which differences, be it remarked, are in no small measure inherent to the present nature of things), while endeavouring to secure for their profession that esteem in which it should be held.

The formation of a Chemical Guild would quickly engender a reformation among the disciples of the craft, who henceforth would not be regarded as fanatics by the outside world, and who would then be encouraged rather than tolerated as now. Such a guild too, would be especially powerful in overthrowing an evil which exists on all sides, viz., that exerted through the agency of cliques.

That a provisional committee may be formed which shall invite chemists to attend a meeting, with the view of establishing such a guild, is much to be desired.—I am, &c.,

Charles T. Kingzett.

INFUSING TEA.

To the Editor of the Chemical News.

Sir,—It has often been stated that the boiling of hard water softens and renders it more valuable for cooking purposes, for the using of soap, and for the making of tea. It is so stated in evidence given before the Royal Commission appointed "To Enquire into the best Means of Preventing the Pollution of Rivers, and the Domestic Water Supply of Great Britain." The Commission sat in 1868. Now my experience in reference to the last named article, viz., tea, is the exact reverse of this. If the same quantity (about the weight of a sixpenny piece) of a given Congou tea, be put into two tasting pots, and the water used for one be exactly at the boiling-point, and that for the other be allowed to boil ten minutes, it will be found that the infusions (liquors) thus made (each having been infused five minutes) bear little or no resemblance to each other. The former made from water at boiling-point will have a liquor of a deep red colour resembling polished mahogany; the latter made with the same water which has boiled for ten minutes will be light in colour, resembling newly polished oak; thin, brackish, and flat to the taste, and worth 50 per cent less money.

I have proved this often with water from Derby, Leicester, Dover, and Plymouth, and many other towns, the water supplies of which differ enormously in character, but the effect is always the same, no matter if the water be soft or hard.

If any one could enlighten me why ten minutes boiling should create this great difference, they would confer a boon.—I am, &c.,

Frank Ranger.

47, and 20, Botolph Lane, E.C.,
March 7, 1876.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences. No. 7, February 14, 1876.

Ethers of the Hydracids.—M. Berthelot.

Formation of the Amides.—M. Berthelot.

Hyposulphite of Potassa.—M. Berthelot.—Three thermo-chemical papers, to which justice could not be done in an abstraction.

Laws of Gases.—M. D. Mendeleeff.—The author endeavours to find a closer approximation than the laws of Mariotte, of Gay-Lussac, and of Ampère and Avogadro.

Isomeric Rosanilins.—M. A. Rosenstiehl.—Reserved for insertion.

Optical Inactivity of a Reductive Sugar Present in Commercial Products.—MM. Aimé Girard and Laborde.—A reply to M. Maumené's complaint that the authors have ascribed an opinion, which he claims, to M. Dubrunfaut.

New Element in the Determination of Chemico-Calories.—M. Maumené.—The author shows that liquids of widely different characters experience a molecular alteration without any change in their nature. The effect of heat—a purely physical influence—gives them a species of *temper*, during which their chemical reactions show abnormal numbers of chemico-calories.

New Acid Pre-existing in the Recent Milk of Mares.—M. J. Duval.—The author has discovered in mare's milk a proximate principle not found in the milk of ruminants. Equinic acid crystallises in groups of small needles, not volatile without decomposition, of a fragrant odour and peculiar taste. Its reactions with nitrate of silver, perchloride of iron, chloride of gold, &c., distinguish it from hippuric acid.

Revue Universelle des Mines, de la Metallurgie, de Travaux Publics, des Sciences et des Arts Appliques a l'Industrie, November and December, 1875.

This issue contains no chemical matter.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

Improvements in the preparation and treatment of soaps, and in combining therewith certain vegetable, farinaceous, or equivalent natural matters; also in apparatus or means therefor; parts of which improvements are applicable to other soaps. W. Green, St. Laurence, Thanet, Kent. January 13, 1875.—No. 129. This invention consists in the production of soaps possessing emollient and curative properties, by the admixture therewith of a larger percentage than heretofore employed of seaweed or extracts thereof, or similar or equivalent matters, or saponified wheaten flour or similar matters, together with soluble glass, liquid quartz, silicate of soda, or the aqueous solution of any of the chemical or commercial varieties and forms of silicates of soda or potassa, and other ingredients, as rosin, borax, steatite, &c., which, while assisting to give firmness to such soaps, will not neutralise the properties of the seaweed or equivalent matters employed; also the production for such purposes of a saponaceous fluid or paste, by the admixture with seaweed or equivalent matters of ingredients as before described, together with saponified or partially saponified farinaceous vegetable, animal, mineral, bituminous, or other cheap or refuse saponifiable matter. Several processes are described, showing special modes of applying the invention to ordinary household soaps, also to perfumed, coloured, medicated, farinaceous, glycerine, tar, saccharine, "milling," and other special or fancy soaps, and soap-powder. A mode is also described of mixing such matters with soap made by the cold process, and also by grinding, or equivalent means without melting. The inventor further claims the admixture of such matters with all kinds of soaps, however made, when from 50 to 100, or from 100 to 300 per cent and upwards of seaweed, or extracts, or equivalent matters are employed. The invention also comprises certain modes of treating seaweed or similar matters for obtaining mucilage, pulp, or powder; also the use of vacuum-pans or other apparatus for boiling or melting such soaps or fluids at a low temperature; also the use of stirring or agitating appliances driven by power in the manufacture or treatment of such soaps or fluids; also certain apparatus for ornamenting such soaps, consisting of appliances for interlacing, plugging, pouring, cutting, and figuring, which appliances are applicable to other soaps; certain terms as, "seaweed soap," and equivalent appellations are employed for distinguishing those soaps from others.

Improvements in the purification of coal-gas. Major-General Scott C.B., Ealing, Middlesex. January 13, 1875.—No. 135. The objects of this invention are (1) the removal of the carbonic acid from the gas by means of magnesia; (2) the breaking up of the bisulphide of carbon; and (3) the abstraction of the carbonate of ammonia from the gas-liquor.

An improved method of and apparatus for preventing the formation and explosion of gas in the storage, transport, and delivery of gaseous or inflammable oil or spirit. G. R. F. Simbaldi, New Cross, Kent. (Partly a communication from P. Simbaldi, Paris.) January 13, 1875.—No. 136. This invention relates to a novel method of and apparatus for preventing explosions of the gas generated from petroleum and other like gaseous and inflammable materials in the storage or transport, or measuring and delivering of the same. The said invention consists, first, in storing the oil or spirit in a vessel in such a manner that to be withdrawn therefrom it must be displaced by the introduction of another liquid of different specific gravity, so that there is never any empty space in the vessel above the gaseous liquid, and therefore no gas can be generated from the said liquid in the vessel. The said invention also consists in apparatus composed of a cistern or reservoir of iron or other suitable material in which the petroleum and other oil or spirit is stored, and from which the same is drawn off ready measured.

Improvements in the manufacture of sulphates, and in apparatus employed therefor. J. Hargreaves, Widnes, Lancaster. January 14, 1875.—No. 147. This relates to the well known direct action process for the manufacture of sulphates of soda and potassa, and consists—First. In making each joint of the sulphurous acid flues pass through a box or well containing fine sand or like material. Second. In forming the pyrites burner doors of a fire-brick tile or non-conducting material contained in a frame. Third. In placing the converting chambers in series back to back, and passing the sulphurous acid flue between them. Fourth. In superheating steam before admixture with the sulphurous acid by passing such steam through a chamber of finished sulphate, and in drawing air from a chamber of finished sulphate through a newly-charged chamber. Fifth. In using vessels of water to cool, when too hot, the gases issuing from the exhauster, and heat such gases when too cold. Sixth. In forming the enclosing walls of pyrites burners double, and passing steam through the space thus formed, such steam is afterwards mixed with the sulphurous acid; in making openings from the said space into the pyrites burners, and in passing steam through the pyrites burners. Seventh. In using an Archimedean screw, continuous scrapers, or travelling aprons to withdraw finished chloride from the chambers. Eighth. In passing the evolved gases through cooling syphons placed between the exhaust and the condensing tower. Ninth. In consolidating and breaking salt by passing such salt on an endless band between rollers through a heating chamber, and finally through breakers rollers.

MEETINGS FOR THE WEEK.

SATURDAY, 11th.—Physical, 3. "Influence of Light on the Electric Conductivity of Selenium, and on a Selenium Photometer," by Prof. W. G. Adams, F.R.S. "On some Problems connected with the Flow of Electricity in a Plane," by O. J. Lodge.

MONDAY, 13th.—Medical, 8.
— London Institution, 5.
— Royal Geographical, 8.30.

TUESDAY, 14th.—Civil Engineers, 8.
— Royal Institution, 3. "On the Classification of the Vertebrated Animals," by Prof. Garrod.
— Society of Arts, 8. (African Section). "The Diamond Fields of South Africa, and their Influence on the Native Races of the Neighbourhood," by J. B. Currey.

WEDNESDAY, 15th.—Society of Arts, 8. "A New Bridge for Providing for the Traffic across the Thames below London Bridge," by Frederick Barnett.
— Meteorological, 7.
— Society of Public Analysts, 6. "The Determination of Quinine in Organic Liquids," by A. H. Allen, F.C.S. "On an Abnormal Sample of New Milk," by J. H. Pattinson. "The Determination of the Melting-Point of Butter and Other Fats," by T. Redwood, Ph.D. "On the Detection of Alum in Bread," by J. A. Wanklyn. "On the Analysis of Butter," by J. Muter, Ph.D., M.A.

THURSDAY, 16th.—Royal, 8.30.
— Royal Institution, 3. "Polarised Light," by Mr. Spottiswoode.
— Royal Society Club, 6.30.
— London Institution, 7.
— Zoological, 4.
— Chemical, 8. "Experiments with Crystallised Glycerin," by Dr. Roos. "Notes on the Fatty Acids, and on a suggested Application of Photography," by W. H. Hatcher. "On Stibine," by F. Jones. "On the Use of Platinum in the Ultimate Analysis of Carbon Compounds," by Ferdinand Kopfer. "The Action of Sulphuric Acid on Naphthalen," by Dr. Stenhouse and Mr. Groves. "Action of Organic Acids and their Anhydrides on the Natural Alkaloids," by Mr. Beckett and Dr. Wright.

FRIDAY, 17th.—Royal Institution, 9. "Feudal Property on the Eve of French Revolution," by Sir H. Maine.
— Society of Arts, 8. Chemical Section. "The Preparation of Dextrin-Maltose (Malt-Sugar), and its Use for Brewing and other Purposes," by W. Valentin, F.C.S.

SATURDAY, 18th.—Royal Institution, 3. "Human Senses," by Prof. Robertson.

THE CHEMICAL NEWS.

Vol. XXXII. No. 851.

DISCOVERERS AND ?

"Sic vos non vobis mellificatis apes."

It has more than once fallen to our lot to vindicate the claims of original discoverers in the pages of this journal. It sometimes happens that the same discovery is made by two men quite independently of each other. In such cases, although both may deserve equal credit, he who can prove priority of publication is acknowledged to be entitled to the honour attending the discovery.

It also sometimes happens that a discoverer, after his results have been not only published, but fully discussed in the scientific journals, finds them re-discovered, and laid before some illustrious society as an entire novelty, without the slightest reference to his labours. We have even known the "conveyer," as in the case of thallium, to accuse the original discoverer of appropriation.

It is not many years since we drew the attention of our readers to the fact of the well-known process of Parkes for the volumetric determination of copper being claimed by M. de la Follye as an improvement of his own upon the sulphide of sodium process of Pelouze, and, strange to relate, Pelouze himself actually described it as such in a memoir read before the Academy of Sciences. So far as we know—we shall be glad to be corrected if we are wrong—this claim has never been withdrawn, notwithstanding the indignant protests of German as well as English chemists. Now it is not to be expected that one man will surrender his claim until priority of discovery has been clearly established by another; but let this once be done, and he who desires to act honourably will at once concede to his rival the honour due to him. To act otherwise is dishonourable in the highest degree; nor is it, in our opinion, less dishonourable for one scientific man to endeavour to injure, or detract from, the reputation of another. We can understand feelings of national pride, and jealousy of national interests, leading men to leave no stone unturned in their endeavour to claim priority of discovery for a fellow-countryman, but we utterly fail to comprehend the motive which prompts a man to shift the credit of a discovery or an invention from a fellow-countryman to a foreigner. At the risk of being accused of obtrusiveness and egotism we feel bound to ask if this has not been the course pursued by Prof. Osborne Reynolds in his several notices of the Radiometer at the Manchester Literary and Philosophical Society. Prof. Osborne Reynolds we have always regarded as a man of singular ability, a physicist who, by earnest study and close application, has attained to an honourable position in the scientific world. His opinion on subjects connected with mechanical and physical science deservedly commands attention, and it is because we entertain these views of his scientific attainments that we think it necessary to point out what would seem to be a studied injustice unworthy of his present position.

The facts of the case are simple. In December, 1873, the first part of a paper "On Attraction and Repulsion Resulting from Radiation" was read before the Royal Society. The experiments therein described led to the construction of an instrument, which is now well known as Crookes's Radiometer, which was first exhibited at the *Soirée* of the Royal Society on the 7th April, 1875. In December, 1875, our attention was directed to an advertisement in *Nature*, in which Mr. Browning announced that he had been appointed sole agent for a new Radiometer made by Herr Geissler. We at once called on Mr. Browning, and he saw that the advertisement gave undue credit to Herr Geissler, and readily made the necessary alteration.

In January, 1876, it was announced by the Secretaries of the Manchester Literary and Philosophical Society (Prof. Osborne Reynolds and Mr. Baxendell) that at the next meeting Prof. Osborne Reynolds would exhibit and explain Crookes's Radiometer. In the report of the meeting on the 25th January, however, the instrument is described as "Geissler's light-mill." On the 17th February it is announced by circular that at a meeting of the Society on the 22nd inst. Prof. Reynolds will show some further illustrations with reference to the action of "Geissler's light-mills."

Any person unacquainted with the circumstances might infer from the above programme that the "light-mill" was a new and independent discovery of Herr Geissler; yet all the time it is simply the radiometer which has been exhibited before the Royal Society and the Royal Institution. Herr Geissler certainly makes radiometers so as to bear transportation, according to a suggestion given him by the inventor through Prof. Zöllner. The latter distinguished physicist, in an autograph letter, declares—"As regards the name of the instrument, 'Crookes's Radiometer' is the only suitable appellation, expressing at once the merit of the discoverer and the nature of the matter." It is no disparagement to the unimpeachable skill of Herr Geissler to say that the instrument should bear the name of its inventor rather than of its maker.

It is, to say the least, an unfortunate coincidence that the gentleman who has thought fit to employ this novel nomenclature has, with reference to the discovery in question, scarcely shown the candour and courtesy usual in physical and chemical discussions. After the reading of the first paper at the Royal Society Prof. Osborne Reynolds, in a letter to the editor of *Nature*, and in a paper which was read before the Royal Society on June 18, 1875, gave it as his opinion that the results we had obtained were in part due to evaporation and condensation, and that they afforded a direct proof of the truth of the kinetic theory of gases. Both in a letter to *Nature*, and in a lecture delivered before the Physical Society on the 20th of June, we brought forward what we conceived to be reasonable arguments against this supposed explanation. We stated that our impression was that the repulsion caused by radiation was directly due to impact upon the surface of the moving mass, and not secondarily through the intervention of air currents, electricity, or evaporation and condensation, but that we did not wish to insist upon any theory of our own, our object being to ascertain facts, varying the conditions of each experiment, so as to find out what are the necessary and what the accidental accompaniments of the phenomena. By working steadily in this manner, letting each group of experiments point out the direction for the next group, and following up as closely as possible, not only the main line of research, but also the little bye-lanes which often lead to the most valuable results, after a time the facts will group themselves together and tell their own tale. The conditions under which the phenomena invariably occur will give the laws, and the theory will follow without much difficulty.

At the meeting of the British Association in August last, Prof. Reynolds said* "he thought that some energy was given to the moving body which enabled it to propel itself. He did not desire to throw any slight upon the work of Mr. Crookes, *but the latter should not produce facts to subvert preconceived notions of the nature of things*, and deprecate explanations being given in accordance with principles previously well established."

Whether or not in what we have stated above we can fairly be charged with deprecating *explanations* given in accordance with principles previously well established, we leave to the judgment of our readers.

Since our earlier researches we have vastly improved the apparatus, and carried out numerous experiments, the results of which are embodied in three subsequent papers

* *Bristol Daily Post*, September 1, 1875.

read before the Royal Society. The radiometers first made are clumsy in the extreme compared with those we now use, and we have long discarded the use of instruments made of metal or talc, which substances, being used by Geissler, give rise to varying results. Is it not then a further injustice for Prof. Osborne Reynolds to attempt to explain away our results because they differ from those obtained by him in his few experiments with an instrument vastly inferior to that used by us? We are informed that at the meeting of the Literary and Philosophical Society, to which we have referred, he exhibited an apparatus to prove that the whole matter was a simple mistake of ours, and that what we thought to be an effect of light was merely an effect of heat, and that he had demonstrated by this apparatus that the heat generated by the impulsion of the light upon the vanes of Geissler's light-mill was sufficient as heat to produce all the effects we have obtained.

Our correspondent says the description was not so clear as it might have been, and he is not certain that he has correctly described Prof. Osborne Reynolds's present theory. We shall therefore refrain from making any remark upon it until we are in possession of an authentic report, but from what we can gather Professor Reynolds seems to have arrived at an opinion which is contained in a paper communicated by us to the Royal Society some time ago, in which we entered very fully and *experimentally* into the question of light or heat in connection with these phenomena, and gave reasons for supposing that the rays of light falling on the blackened surface were lowered in refrangibility and converted into thermometric heat, the motion being connected with the radiation of this heat back again.

We have repeatedly stated that the subject is surrounded with mystery, and nothing gives us greater satisfaction than to know that other scientific men are working at it and endeavouring to elicit new facts. The great incentive for scientific men to prosecute original research should be the discovery and development of new truths and the elaboration of old ones. The cause of science will be best promoted by its workers being eminent for their candour and courtesy, as well as for their scientific attainments.

PAPYRUS EBERS:
THE EARLIEST MEDICAL WORK EXTANT.

By H. CARRINGTON BOLTON, Ph.D., of New York.

(Concluded from p. 92.)

The recipes and prescriptions contained in this treatise are evidently collected from various sources, some of them being quoted from still more ancient writings. It bears internal evidence of having been used in the healing art, for the word "good" occurs in the margin in several places, written in a different handwriting from the body of the work, and with lighter coloured ink.

Ebers thinks the compilation was made by the College of Priests at Thebes, basing his conjecture partly on the locality in which it was discovered. The other great Egyptian Universities were located at Memphis, Heliopolis, Sais, and Chennu.

Ebers gives a synopsis of the contents of the entire work, and a literal translation of the first two pages of the roll, reserving a commentary and fuller translation for a future publication. A hieroglyphic translation of a portion of the Hieratic manuscript also accompanies the plates; the latter, 107 in number, are faithful and beautiful reproductions of the original papyrus, in the same yellow-brown colour. The second volume contains a Hieroglyphic-Latin Glossary by Stern. Before proceeding to give details of its contents, one more peculiarity is worth mentioning. Though the pages are carefully numbered, the figures 28 and 29 are omitted, while the text is continuous. Ebers conjectures that the writer either accidentally forgot his count, or abstained from using these numbers for superstitious reasons, the discussion of which we cannot here enter upon.

As already remarked, the work is divided into chapters or sections. We cannot give Ebers's synopsis in full, but a fair insight into the character of the treatise may be obtained from the selected headings of sections, and extracts here following:—

Contents of Papyrus Ebers.

Headings of chapters (selected).

The numbers refer to the pages of the papyrus.

1. Of the preparation of medicines.
25. Of salves for removing the *uhau*.
47. Catalogue of the various uses of the *Tequem* tree.
48. Medicines for curing the accumulation of urine and diseases of the abdomen.
55. The book of the eyes.
65. Medicaments for preventing the hair turning grey, and for the treatment of the hair.*
66. Medicines for forcing the growth of hair.
79. Salves for strengthening the nerves, and medicines for healing the nerves.
85. Medicines for curing diseases of the tongue.
89. Medicines for the removal of lice and fleas.
91. Medicines for ears hard of hearing.
99. The Secret Book of the Physician. The science of the beating of the heart, and the science of the heart as taught by the priestly physician Nebsecht.

Ebers encountered immense difficulties in the work of deciphering this papyrus; as an example of the obstacles met, he gives the following literal translation of a diagnosis beginning on Plate XXXVI., line 4:—

"Rules for the *re het*, that is, suffering in the pit of the stomach (pylorus or cardia.) When thou findest anybody with a hardening of his *re het*, and when eating he feels a pressure in his bowels (*chet*), his stomach (*het*) is swollen, and he feels ill while walking, like one who is suffering from heat in the back, *tau nu peht*, then look at him when he is lying outstretched,† and if thou findest his bowels hot and a hardening in his *re het*, then say to thyself, this is a liver complaint, *sepu pu n merest*. Then make thyself a remedy according to the secrets in botanical knowledge from the plant *pa chestet* and from scraps of dates. Mix it and put it in water. The patient may drink it on four mornings to purge his body. If after that thou findest both sides of his bowels (*chet*), namely, the right one hot, and the left one cool, then say of it: That is bile. Look at him again, and if you find his bowels entirely cold, then say to thyself: His liver (? *merest*) is cleansed and purified; he has taken the medicine, *sep nef sep*, the medicine has taken effect."

The following is the translation of the first four lines of Plate I.:—

"The Book begins with the Preparation of the Medicines for all portions of the body of a patient. I came from Heliopolis with the Great Ones from *Het aat* the Lords of Protection, the Masters of Eternity and Salvation. I came from Sais with the mother-goddesses who extended to me protection. The Lord of the Universe told me how to free the gods from all murderous diseases."

The work abounds in prescriptions, of which the following are samples:—

"Beginning of the Book of Medicines. *To remove illness from the stomach.*

"Rub up the seed of the Thehui plant with vinegar, and give the patient to drink.

* "Verily," there is nothing new under the sun" (Eccl. i. 9); hair invigorators, hair dyes, pain killers, and flea powders, were evidently fashionable "two years ago."

† It is curious to note here, that (according to Dunglison) Diodorus states, the priestly physicians of Egypt formed their diagnosis principally on the position which the patient assumed in bed.

"*The same for sick bowels.*

Caraway seed	½ drachm.
Goose fat	½ ,,
Milk	1 tenat.

Boil, stir, and eat.

The same.

Pomegranate seed	½ drachm.
Sycamore fruit (?)	½ ,,
Beer	1 tenat.

"Treat as above."

In the original, the arrangement of the substances and quantities in two columns is the same as here given. The weights are written in red ink.

Other prescriptions contain reference to pills made by mixing certain substances with honey and rolling them into little balls.

The weights and measures in this unique work deserve a more lengthy notice than space will permit. A series of special signs indicate measures of volume, and figures with dots above them represent weights. The unit of weight employed is believed by Ebers to bear a close relation to the later Arabic Dirhem or Drachm, which is equivalent to about 48 English grains. But owing to the smallness of the quantities given in the recipes, the unit is probably double the drachm in value. This unit and its divisions are represented in hieroglyphics thus :—

One di-drachm

One-eighth di-drachm

One-sixteenth di-drachm

One thirty-second di-drachm

One sixty-fourth di-drachm

The fractions ½, ¼, ⅛, 1/16, always recurring, and 1/32 predominating, a quaternary arrangement which was superstitiously regarded as beneficial.

The unit of volume is thought to be the *tenat*, which is equivalent to six-tenths of a litre. This unit and its sub-divisions are represented by arbitrary signs of which the following is an attempt at reproduction :—

Unit or tenat

½ ,,

¼ ,,

⅛ ,,

¼ + ⅛ or ⅜ ,,

½ + ¼ or ¾ ,,

⅛ + ⅛ or 1/16 ,,

½ + ⅛ or ⅝ ,,

When equal parts of the components of a prescription are taken it is indicated by a light, short, vertical dash, placed opposite each substance thus, |.

The writer failed to detect any sign at the beginning of the several recipes equivalent to the ℞ now used by physicians, and which, though generally regarded as the initial letter of the Latin word Recipe = take, has also been referred to an Egyptian source. This ℞ is said to have been originally the same as the symbol of Jupiter ♃, and to have been placed at the beginning of formulæ to propitiate the King of the Gods that the compound might act favourably.

The symbols in common use for scruples ℈, drachms ʒ, and ounces ℥, are said to have been derived from inscriptions on the ancient monuments of Egypt, and the resemblance of our sign for drachm to that of the ½ *tenat*, is certainly very striking.

Ebers states in his Preface, that notwithstanding there are to be found in this great work many incantations and conjurations, from which the priestly physicians could not abstain, still there is no hocus-pocus nor gibberish in it; on the contrary, it shows that it was possible to write in the 16th Century B.C., complex recipes, and that they understood how to administer with care the medicines prescribed. Moreover, sorcery was forbidden in ancient times in the strongest manner, and the alchemistic Magi were punished in the reign of Rameses III. with death. The art of the physician was lost in the post Christian era. Science became more and more tinged with magic, and was gradually obscured and degraded by it.

We cannot do better, in conclusion, than to quote the testimony of the learned Librarian of the Astor, with reference to the intrinsic value of this papyrus; he says.—

"It is hardly possible to exaggerate the literary, scientific, and historical importance of this remarkable document. It is the largest, best preserved, and most legible text in the language of Hieroglyphics, and does not speak vaguely of incomprehensible and fantastic ideas, but furnishes indubitable insight into different phases of the life of the ancient Egyptians."

DETERMINATION OF VERY SMALL AMOUNTS OF COPPER.

By J. M. MERRICK, B.Sc.

In the researches of M. Bergeron and l'Hôte,* upon the occurrence of very minute quantities of copper in the human organism, these *savants* employed a colorimetric test based upon the blue tint which ammonia gives with salts of copper, and constructed a scale of colours, showing from 2 m.grms. down to 0·5 m.grm., and state that if the quantity of copper is less than 0·5 m.grm. the colour method fails to indicate it, but yellow prussiate of potash still gives the characteristic red colouration.

I would here add to this statement the outline of a gravimetric method which, in very numerous trials, has led, in my hands, to what I consider trustworthy results, even when the amount of copper present was very much less than 0·5 m.grm.

It consisted simply in concentrating to a very small bulk the solution suspected to contain copper, and then depositing the copper, if present, upon platinum, by the battery. I used for a depositing cell a very small test-tube, on a foot cut off, so as to give a vessel about 1½ inches deep. Into this was introduced the solution acidified with sulphuric acid, and a platinum anode and cathode—each about 1 inch long, and ⅛th of an inch or less wide—were hung face to face, and very close together, and, the circuit being completed, very satisfactory depositions of copper were obtained with incredibly minute quantities of

* *Comptes Rendus*, lxxx., p. 268.

the metal. The amounts were determined by the increased weight of the cathode (which was provided with a platinum wire soldered on with gold, by which it was conveniently hooked on to the balance), and by the loss in weight of the same on washing it with nitric acid. The platinum was polished and heated red-hot before the first weighing, and then gently heated before hanging in the solution. The contrast in colour between deposited copper and bright platinum is, of course, striking and characteristic. In this way 0·1 m.grm. of copper may be, I believe, safely determined, while for mere qualitative analysis this method may be employed where the amount is even smaller.

Laboratory, 59, Broad Street, Boston, U.S.A.,
February 14, 1876.

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 91.)

Being cooled to the temperature of spring-water it passes into an expansion piston-machine, where it yields power in the same manner as steam. In consequence of the great expansion there is a considerable fall of temperature (see below), sometimes reaching $-20°$ to $-30°$. The gas as it escapes from the machine can be used for cooling any article, for producing ice, and, finally, it may serve for the manufacture of soda-water. The machine shown at the Exhibition was two-horse power. The cost of the gas is said to be quite covered by the value of the copperas produced; 1 cwt. sulphuric acid (costing 5 florins Austrian) and 1 cwt. iron-spar (1 florin 50 kreutzers, together 6 florins 50 kreutzers) yielding 240 lbs. copperas (at 3 florins per cwt.), worth 7 florins 20 kreutzers. The idea of this combination is doubtless ingenious, and in individual cases it may prove remunerative in practice, but for general application it is not suitable. One cwt. iron-spar yields about 20 kilos. carbonic acid, which, at a pressure of 5 atmospheres, represent 2 cubic metres. On expansion to 1 atmosphere this quantity can theoretically produce at most a working-power of 170,000 kilogram-metres, equal 1 horse-power for about half-an-hour. By expansion the gas loses about 200 heat-units, and at the outside the same amount is available for the production of ice, yielding not more than 2 kilos. Hence it is plain that exceedingly large quantities of materials are requisite, and that it would be difficult to find a sufficient demand for the copperas. The escaping carbonic acid, also, can be but very partially utilised in the manufacture of soda-water, and would require for this purpose to be compressed anew, so that it would appear more advantageous to pass it at once into the water as it issues from the generator.

If the carbonic acid is used for making soda-water as it issues from the ice-receiver, the absorption would take place at about $-5°$, under a pressure of 33 atmospheres, or about six times more than is necessary. The power which the machine must exert to produce this superfluous pressure is totally wasted. The latent vapour-heat of carbonic acid is certainly not yet known, but even if it were high (which, from the great specific gravity, is improbable) enormous quantities of carbonic acid would be required to produce only a moderate yield of ice, far larger than there is any prospect of utilising in the manufacture of effervescing beverages. We can therefore prognosticate no success for the above-mentioned apparatus, and consider that the use of carbonic acid in a circulatory process would be more rational.

* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzehends."

The Ammonia Machine.

At common temperatures ammonia is a gas; under pressure it may be condensed to a liquid. The temperature and pressure of liquid ammonia, according to Regnault, are respectively as follows:—

Temp.—	$+40°$	$+20°$	$0°$	$-20°$	$-30°$	$-40°$ C.
Pressure—	15·5	8·5	4·4	1·84	1·16	0·7 atmos.

Ammoniacal gas is readily soluble in water, which at 0° it saturates with 1050 volumes, or 0·875 in weight. At 20° water absorbs 654 vols., or 0·52 of weight, a little more than half its own weight. In this state it forms the liquid ammonia of commerce. The absorption is attended with a considerable rise of temperature, whence the latent heat of ammoniacal gas may be calculated as 500°, or close upon that of steam. The gas absorbed by water can be entirely expelled by the application of heat. A decrease of pressure has the same effect, in which case the temperature falls.

(To be continued.)

ON THE ACTION OF METALLIC MAGNESIUM ON CERTAIN METALLIC SALTS.

By SERGIUS KERN, St. Petersburg.

In my paper inserted in the Chemical News (vol, xxxii., p. 309) I gave some preliminary remarks on the action of magnesium on some salts, viz., on cobalt chloride and silver nitrate. In this paper I will describe further experiments on the same subject.

Concentrated solutions of salts were used (about 40 c.c. for every experiment): they were left in contact with magnesium ribbons, 0·05 metre long, for about thirty to forty hours.

1. In a solution of lead nitrate magnesium is quickly covered with metallic lead, in the form of a very fine powder, which is soon converted into lead hydrate $[Pb(OH)_2]$.

2. Strontium salts require much more time to be decomposed. A concentrated solution of strontium chloride was in contact with magnesium for two days: a white precipitate was obtained, which was found to be strontium hydrate. The decomposition may be explained by the following formula:—

$$SrCl_2 + Mg + 2H_2O = Sr(OH)_2 + MgCl_2 + H_2.$$

3. Mercuric chloride in contact with magnesium gives a greyish precipitate, which when ignited turns red. This precipitate is a third form of mercuric oxide, which has hitherto been known in two forms—as red and yellow precipitates. This third form is obtained during this reaction as follows:—

$$HgCl_2 + Mg + H_2O = HgO + MgCl_2 + H_2.$$

4. When magnesium is brought in contact with a solution of platinum chloride, hydrogen is evolved very rapidly. After about twenty to twenty-five hours a black precipitate was obtained, which proved to be a mixiure of metallic platinum in finely divided state (platinum-black) and black platinum oxide (PtO_4). On leaving this precipitate for some hours in contact with water, the brown hydrate of platinum was obtained $[Pt(OH)_4]$.

5. With a solution of ferric chloride magnesium is rapidly decomposed, and ferric hydrate is formed by the reaction:—

$$Fe_2Cl_6 + 3Mg + 6H_2O = Fe_2(OH)_6 + 3MgCl_2 + 3H_2.$$

6. Magnesium with zinc salts evolves hydrogen very slowly. A solution of zinc chloride was used, and after forty-eight hours a small amount of zinc hydrate was obtained, owing to the decomposition of the zinc salt.

7. In a solution of natrium chloride magnesium also evolves hydrogen very slowly. This salt is converted

during this reaction into natrium hydroxide (HNaO). In such a solution red litmus-paper quickly turns blue.

These experiments show that most of the salts by the action of magnesium are transformed into their oxides or hydrates. It is very remarkable that such stable compounds as strontium chloride and natrium chloride are easily decomposed into their corresponding hydrates. The reaction of magnesium on mercuric chloride, yielding mercuric oxide in a new third allotropic form, is also very interesting.

If magnesium is ever prepared cheaply enough it will be a very good substitute for other metals in the construction of galvanic cells.

PROCEEDINGS OF SOCIETIES.

PHYSICAL SOCIETY.

March 11, 1876.

Professor G. C. FOSTER, F.R.S., President, in the Chair.

THE following candidates were elected Members of the Society:—W. H. Coffin, T. D. Humpidge, and the Rev. G. H. Hopkins.

Prof. W. G. ADAMS gave an account of some researches on which he has been engaged in connection with the influence of light and heat on the electric conductivity of selenium, and exhibited numerous experiments in illustration. The subject has also been studied by Lieut. Sale and Dr. W. Siemens, of Berlin, and as a general result it is found that, after it has been kept in the dark, the resistance of the metal is diminished by exposure to light. The effect, however, both of heat and light, is different in the several states through which the metal passes. Thus, when a piece of amorphous selenium is gradually heated to about 100° C., kept at this temperature, and slowly cooled, its resistance at first is so great that it cannot be measured by the ordinary arrangement; but as its temperature increases the resistance diminishes, and increases again more slowly when the metal is allowed to cool. The resistances of several pieces, which at the higher temperature were from 1 to 3 megohms, were found to be from 100 to 130 at the ordinary temperature. If this selenium be placed in a paraffin bath, and heated, its resistance diminishes, and when the temperature is kept constant above 140° C. for some hours, and the metal is then slowly cooled, it assumes a crystalline structure, and its resistance *diminishes* as it cools. The resistance of such selenium, at ordinary temperatures, *increases* with the temperature. The effect is more marked as the temperature of the paraffin bath is increased. In studying the effect of light, the metal—which had been heated to 140° C.—was exposed to a candle at distances of 1, ½, and ¼ metre. The initial resistance being 115,500 ohms, the readings in these three cases were 112,000, 108,700, and 101,500. Deducting each from the initial number, we have 3500, 6800, and 14,000 ohms as the changes of resistance due to exposure at these distances. Hence the effect of light varies inversely as the distance, or, what amounts to the same thing, directly as the square root of the illuminating power. These considerations have led Prof. Adams to suggest the use of selenium for comparing the illuminating powers of different sources of light, and he exhibited the arrangement which he proposes to use for this purpose. The action of light of different degrees of refrangibility was then exhibited by allowing the light from several parts of a spectrum of the electric lamp produced by a bisulphide of carbon prism to fall on the metal, the remainder being cut off by means of a screen in which there was a narrow slit. The violet light gave a deflection of about two divisions on the screen, the greenish yellow four, the orange-red five and a half, and the deep red nine divisions. The effects produced by the greenish yellow and the deep red are at times nearly equal. It may easily be shown by raising the temperature of the metal that the effect of light on its conductivity is essentially the same in kind at a low and moderately high temperature. The fact that light and not dark heat produces the observed effect has been shown by sending the beam through solutions of iodine in bisulphide of carbon, when a very small effect on the metal was always observed, but this may be assumed to have been due to light, as in all cases it was possible to see the form of the carbon points through the solution. This fact may also be strikingly shown by exposing selenium, through which a current is passing, to the flame of a Bunsen burner, first, when in its ordinary condition, and afterwards with the air openings at the base closed. It was shown that, whereas in the first case the effect produced was equivalent to three divisions of the scale, in the latter case one-tenth of the current produced by the exposure deflects the needle to the end of the scale.

Prof. STONEY pointed out that the action of light on selenium increases with the amount of heat accompanying that light. He suggested that the photographic effect of selenium might have some relation to the action under consideration.

Prof. BARRETT thought that a solution of iodine in bichloride of carbon might give more satisfactory results, for this liquid is more opaque than a solution in the bisulphide.

Prof. GUTHRIE enquired whether the action on the metal is superficial or extends into the mass. If a definite answer could be given to this question it seems likely that we might determine whether electricity flows on the surface of a conductor or is uniformly distributed throughout the mass; for if we have an *opaque* substance, the conductivity of which is influenced by light, it would suggest that the former is the case. The question, however, would be very difficult of solution, but perhaps the variations in resistance in two bars of selenium, which only differ in diameter, might throw some light on the subject.

Prof. ADAMS, in replying to the various questions, mentioned that he has examined the effect of light deprived of the ultra-chemical rays, but the change seemed to have no effect. He has also made experiments on the influence of light after passing through glasses of different colours, but there is considerable difficulty in ascertaining how much of the effect is due to the degree of refrangibility, and how much to the change in the intensity of the light. The effect is most intense in the greenish yellow and the deep red, and it is worthy of remark that at these two points groups of bands are observed in the spectrum of the metal. He compared the effects observed with phosphorescent effects, in which case there is certainly some superficial action. The conductivity may be improved by some alteration of the surface, but Prof. Adams has suggested that light may modify the molecular condition of the metal so as to call into play something of the nature of electromotive force. He showed an experiment which proved that if the resistance of a bar of selenium is measured with a given current passing along it in one direction, then, when this current is reversed, the resistance is entirely different. This seems to bear some analogy to electrical polarisation, only the action is in an opposite direction, for it appears to be such as to help the current rather than oppose it.

Prof. JOHNSTONE STONEY then explained the theory which he has suggested in explanation of the phenomena observed in the radiometers of Mr. Crookes, which has been published in the *Philosophical Magazine* for the current month. The theory rests on the supposition that there is an excessively small trace of residual gas in the sphere in which the moving discs are enclosed. When the apparatus is exposed to heat the blackened side of the disc is slightly warmed, and this warms a layer of air in contact with it. At the ordinary atmospheric pressure, Prof. Stoney assumes the layer so warmed to have the thickness of a sheet of paper, when the temperature of the

disc is 20° C. above that of the surrounding air, and on such a supposition we may calculate it for any other pressure and temperature. If we diminish the pressure the thickness varies inversely as the pressure raised to the power $\frac{1}{2}$. Thus, if the disc be raised 1-10° C. above the surrounding air, and the exhaustion carried to the 1-10,000th of an atmosphere, the layer will have a thickness of more than a decimetre, and the effect of the air will then be peculiar. If the gas is of such a density that the glass envelope is beyond the range of this action, the gas beyond the limiting distance will be cold, but if the effect reach the glass conduction will take place to it. There will then be a procession of warm molecules towards the glass, where they will be cooled down, and form a number of cold slow-moving molecules, which will go back to the disc and beyond it, and these processions will be intermixed with molecules taking no part in the action. In consequence of this, very few members will travel far in their paths; a portion of the motion of heat, however, will be carried forward in the right direction. So long as these processions go on, the slow-moving molecules which reach the front of the disc are thrown off more vigorously than from the back. Prof. Stoney considers the pressure thus produced to be that measured by Mr. Crookes. With a pressure of the gas of 1-10,000th of an atmosphere, an elevation of temperature of 1-10° C. will produce the force actually observed; while, if the exhaustion be carried to 1-100,000th, the elevation of temperature necessary will be 8-10° C. Thus, with the greater pressure, a lower temperature will suffice, but other influences will then be brought into play, tending in an opposite direction. It was pointed out that on this theory the action may be considered as closely resembling electricity, and Mr. Crookes has shown that the glass envelope is often itself slightly electrified.

Mr. Crookes said that Prof. Stoney assumed more than the facts would warrant. He considered that 1-10° C., the temperature assumed by Prof. Stoney, was far in excess of what actually is required to produce the observed effects, for the discs are strongly moved by light free from heat falling on them; for example, when placed in front of a window behind screens of water or alum. With discs of platinum there is attraction throughout all the stages in the exhaustion from 1 m.m. of mercury until a fairly good vacuum is attained. If, however, the exhaustion is continued a neutral point is reached, beyond which there is strong repulsion, and this is strongest in the very best vacua which will not conduct an induced spark. Moreover, the assumed exhaustion of 1-10,000th of an atmosphere was much inferior to what he had often experimented with. Prof. Stoney would seem to show that the action should vary with the size of the apparatus, but this is not found to be the case. Mr. Crookes enquired whether the extremely rapid rotation of the disc would not interfere with the permanent difference of temperature between the front and back surface which was required to produce the motion on Prof. Stoney's hypothesis.

Prof. Stoney pointed out the enormous velocity of the molecular motions in proof that the rotation of the discs would be without influence. Thus, in such a gas as oxygen, the velocity of the molecules is about 500 metres per second. The fact that similar velocities of rotation are observed in radiometers of different diameters only shows that they are all within the limits of the thickness of the layer, which he considers to produce the effects observed.

NEWCASTLE-UPON-TYNE CHEMICAL SOCIETY.

General Meeting, January 27th, 1876.

John Pattinson, President, in the Chair.

The minutes of previous meeting were read and confirmed.

Mr. W. F. Henderson was elected a member of the Society.

The name of Mr. R. W. P. Richardson, of Langley Park Colliery, was read for the first time. Professor Aldis read a "*Note on the Theory of Balances.*"

The President read the following paper:—"*On Gas-Burners.* How best to burn coal-gas so as to obtain the greatest amount of light it is capable of producing is a subject which is perhaps as yet but imperfectly understood, even by those who know most about it. Great improvements have, however, been made in recent years in the construction of gas-burners, resulting from the researches of Frankland, Bowditch, Sugg, Silber, the London Gas Referees, and others; but from many causes, chiefly perhaps for want of information on the subject amongst the general public, these improved burners have come but very slowly into use. The gas-fitters, to whom the choice of burners is usually left, often know as little about the subject as any one, and thus a wretchedly bad kind of burner is in many cases used which burns the gas so as to destroy a great portion of its light-giving power. In the present paper no attempt is made to describe even a tithe of the multiplicity of burners which have been invented. The object is simply to describe the results of an examination I have recently made of a number of burners taken off fittings in various parts of Newcastle, and to show how unfit these burners are to develop the light-producing properties of gas as compared with good burners, which may be had quite as easily as the bad ones.

Gas burners may be divided into two great classes: first, argands, such as give a ring of light and require glass chimneys; and, second, flat-flame burners, which may be sub-divided into what are known as "batwings" and "fishtails," so called from the shape of the flames they produce.

In the experiments I have made, the gas used was of the same quality throughout the whole of the tests. It gave a light equal to 14·1 standard sperm candles when burnt at the rate of five cubic feet per hour in the standard argand burner, known as the Sugg-Letheby burner. Before about seven or eight years ago this was the best burner known, and as it was in use at the time when the Newcastle and Gateshead Gas Company obtained their Act of Parliament, it is still retained as the standard by which the gas is tested. It is but fair to state here that the quality of the gas was unusually low when the experiments were made, the gas usually being equal to about fifteen standard candles. It may be explained for the benefit of the uninitiated that the standard sperm candle with which the gas is compared is one defined in the Act of Parliament as a "sperm candle of six to the pound, burning at the rate of 120 grs. per hour."

I will first of all give the results of the testing of argand burners. The argand burner when properly constructed is the one best adapted for obtaining the greatest amount of light from common coal gas. The air supply, upon which so much depends, is most perfectly under control in such burners. Argand burners are certainly more expensive in their first cost, and perhaps are more troublesome to keep in order than flat flame burners, owing to the occasional breakage of chimneys and other causes, but it will be seen that the amount of light they can produce in comparison with the latter is very great, and would soon compensate for their extra cost and the extra trouble of keeping in order, especially in private houses. They require the gas to be supplied to them at a uniform pressure, otherwise they are liable to smoke when the pressure is increased, and more gas passes through than they can burn. They should, therefore, always be used with regulators for regulating the pressure of the gas. These may be conveniently placed near the supply meter.

In each of the following tables the first column shows the actual amount of gas consumed per hour in cubic feet during the experiments; the second gives the illuminating power of the gas consumed expressed in standard sperm candles; the third gives the illuminating power calculated per five cubic feet of gas:—

Argand Burners.

Kind of Burner.	Cubic feet of Gas used per hour.	Illuminating power in Candles.	Illuminating power per 5 Cubic feet of Gas per hour.
Sugg-Letheby Standard ..	5·0	14·10	14·10
Sugg's "London Argand"	5·0	15·90	15·90
Sugg's "Improved London Argand"	4·5	16·08	17·86
Silber's Argand	5·0	17·80	17·80
Common Argand	5·0	11·20	11·20
,, ...	7·0	17·80	12·70

The common argand here mentioned was one similar to a great number used in shop windows in Newcastle. It will be seen that with the Sugg's Improved London Argand and Silber's Argand as much light is produced when burning five feet of gas as is produced when burning seven feet of gas in the common argand, thus showing a saving of 40 per cent over the last-named burner.

Flat flame burners do not consume the gas so as to give as much light from a given quantity of gas as argands. This is perhaps chiefly owing to the circumstance that it is necessary to make the gas issue from the burner under a certain amount of pressure, in order to produce the required shape of flame, and this pressure causes a portion of the gas to mix with too much air, so that it becomes over-burnt, as in the Bunsen burner. The best flat flame burners are those in which this pressure is reduced to the minimum amount found necessary, and such burners generally have some contrivance for checking the pressure of gas supplied at the mains. But although flat flame burners are not so economical as argands in their consumption of gas, yet they possess other advantages which probably will always cause them to be extensively used. The first cost of the burner is very trifling, no chimneys are required, they are not so liable to smoke under varying pressures of gas as argands, and they are easily lighted and attended to.

It is in this class of burner that the most extraordinary differences in quality for burning gas so as to produce light have been found. The following table shows the results of my tests of various new batwing and fishtail burners which can be had in Newcastle. Some of the burners were tried with different consumptions of gas.

New Batwing and Fishtail Burners.

Kind of Burner.	Cubic feet of Gas used per hour.	Illuminating power in Candles.	Illuminating power per 5 Cubic feet of Gas per hour.
Bray's No. 4 fishtail ..	4·0	5·02	6·28
,, ..	5·0	5·80	5·80
Bray's No. 6 fishtail ..	5·0	9·00	9·00
Bray's No. 8 fishtail ..	5·0	11·80	11·80
,, ..	7·0	14·21	10·15
Brönner's No. 4 batwing	4·0	10·10	12·62
,, ..	5·0	11·60	11·60
Sugg's No. 4 batwing ..	4·0	8·40	10·50
,, ..	5·0	10·90	10·90
Batwing with narrow slit	5·0	8·60	8·60
Batwing used in street lamps	5·0	11·60	11·60
Fishtail with small platinum disc in flame ..	5·0	10·20	10·20
No. 5 fishtail—metal top	5·0	7·50	7·50

It is difficult to get exact uniformity in the same kind of burner of each manufacturer, and the above burners may be inferior to others of the same kind. They were, however, selected at random. The results show that the best argand burners produce upwards of one-third more light from the gas than the best of the flat flame burners, so that, taking light-producing properties alone into consideration, there is an advantage to this extent in favour of argand burners. Bray's, Brönners, and Sugg's are all good burners. It will be seen that Bray's No. 8 fishtail is much better adapted for burning the kind of gas experimented with than the No. 4 and No. 6 fishtail of the same maker.

The next table gives the results of my trials of various burners recently taken from fittings in houses in several parts of Newcastle.

Burners in Use in Newcastle.

Kind of Burner.	Cubic feet of Gas used per hour.	Illuminating power in Candles.	Illuminating power per 5 Cubic feet of Gas per hour.
Batwing—metal top ..	5·0	9·26	9·26
,, ,, double slit	5·0	8·90	8·90
Fishtail No. 3—metal top	2·5	4·10	5·85
,, ,, steatite top	3·7	4·40	6·00
,, ,, ,,	4·0	3·00	3·75
,, No. 4— ,,	4·9	5·20	5·31
,, No. 5— ,,	5·0	7·80	7·80

It thus appears that burners are in use in Newcastle which give a light equal to only 3¾ candles, when burning the same quantity and quality of gas as, when burnt in a good argand, will give a light equal to 17¾ candles, or, if burnt in a good burner of its own class, will give a light equal to 12½ candles, and such burners are very extensively used in Newcastle. Is it, then, a matter of wonder that we occasionally hear complaints of the bad quality of Newcastle gas? By the substitution of good burners for these wretched ones, from three to five times the amount of light will be produced from the same amount of gas; or, if the light of the present burners is sufficient, the same amount of light can be obtained from one-third or one-fifth the amount of gas. In the latter case, besides the saving in cost of gas, there is also the additional advantage of having the vitiation of the air in the room by sulphur compounds and carbonic acid from the burning gas reduced to the same extent.

It is in the hope that public attention will be called to this matter, and the wasteful misuse of gas prevented, that these results are now published.

Mr. FREIRE-MARRECO proposed a vote of thanks to the President.

Dr. LUNGE seconded the motion, which was carried, and the discussion was adjourned until the next meeting.

Mr. M. W. BULLEN exhibited and described the occurrence of specimens of Pectolite, and of supposed Prehnite and Rutile, from Teesdale, for which the thanks of the meeting were offered to him.

Mr. CROOKES's "Radiometer" was exhibited in action.

CORRESPONDENCE.

MR. STEWART'S ANALYSIS OF TELL-TALE LIQUOR FROM SUGAR VACUUM PANS.

To the Editor of the Chemical News.

SIR,—Noticing an article some time ago in the CHEMICAL NEWS (vol. xxxiii., p. 5), entitled as above, by G. C. Stewart, F.C.S., I would like very much, through your valuable columns, to say a few words on it *pro bono publico*.

In the first place, Mr. Stewart has analysed the two sugar-liquors (it being the same liquor, but boiled in two pans), and states that the mechanical construction of the pan causes the one liquor to have more cane-sugar destroyed than the other; therefore the long-necked pan, which produced the worst liquor, is almost, I may say, condemned (by Mr. Stewart).

Again, the "salt-water" used in condensing the vapours sometimes gets down more roads than the tube it is bound for—"accidentally," "peradventure," or "otherwise"—and getting mixed with the sugar-liquor in the tell-tale

safe, I should say this itself destroys at least four times its bulk of cane-sugar.

But Mr. Stewart is not satisfied with telling us all this and the above reasons. He further states that a chemist in charge of a sugar refinery can tell by a continual examination of these liquors whether a panman handles his pan in a proper manner: and in this quiet way he gives us his third (as it seems) reason for the deficiency of cane-sugar in the liquor produced from the long-necked pan. I think in this Mr. Stewart has drawn his line of imagination too far away from "good common sense," which gives his imaginative powers too large a space to work upon; consequently a muddle is the result. But, however, after the liquor has been reduced (in cane-sugar) by "mechanical construction" and "salt-water," I think it hardly fair for Mr. Stewart to say that he could tell whether a pan was handled in a proper manner or not. But what I wish to know is, does Mr. Stewart really blame the panmen for the deficiency in his results in cane-sugar? if so, then his best plan would be to take an average of his three reasons—

"Mechanism,"
"Salt-water," and
"Humanity."

I hope either to see the average, the individual reason, or to say whether the three combined cause the deficiency in cane-sugar of the liquor drawn from the "tell-tale safe" of the long-necked sugar vacuum pan.—I am, &c.,

Thomas McKean.

PRODUCTION OF ANILINE-BLACK BY MEANS OF VANADIUM SALTS.

To the Editor of the Chemical News.

Sir,—In reply to Mr. Higgin's remarks (Chemical News, vol. xxxiii., p. 86) on my patent for vanadium and aniline taken out five years ago, I have to state that I discovered the extraordinary action of salts of vanadium on aniline as early as 1868 and 1869, and made many *successful* experiments in producing aniline-black with these salts. But the very high price and scarcity of vanadium *at that time* prevented me from introducing it commercially. This difficulty is now remedied by the enterprise of Messrs. Johnson, Matthey, and Co., Hatton Garden, who are prepared to supply the various vanadium salts at a comparatively moderate price, for the use of printers and dyers. After taking out my patent I noticed, in Mr. Lightfoot's work on aniline-black, his very interesting laboratory experiment of simply placing pieces of the *rare metals* on cloth saturated with aniline salt and chlorate of potash, with the result that the *metal vanadium* had the powerful effect.—I am, &c.,

Robt. Pinkney.

ORGANISATION AMONG CHEMISTS.

To the Editor of the Chemical News.

Sir,—It seems to me that the benefits of the proposed organisation among chemists could be attained without the Guild which was suggested by Dr. Wright, and supported by those of your various correspondents who have interested themselves in this subject, by means of an Act of Parliament permitting an incorporation of recognised chemists, such as the professors of chemistry at the various hospitals, the Doctors of Science who have gone out in chemistry at the University of London, and the Examiners in Chemistry at the various Universities, the Science and Art Department, &c. (similar to that obtained by the medical circle), with powers to grant diplomas in chemistry, after due examination of candidates for them. This body, when incorporated, might be recognised as the "Royal College of Chemists." The institution of various degrees or grades similar to the various diplomas of physicians and surgeons, &c., could then be effected.

The degrees granted in chemistry by the London University would, by a clause in the Act, then confer a legal status precisely as they do now in divinity, medicine, &c., which status would, of course, be conferred by either of the diplomas of the "Royal College of Chemists," or of any other qualified examining body. It would be advisable that the various Universities now permitted to grant diplomas in medicine should be empowered to confer diplomas in chemistry. The possession of any such diploma would enable its holder to recover fees at law, which, without it, he should not be permitted to do; the giving of evidence as experts in courts of law should also be confined to the possessors of diplomas. Some revenue might accrue to the Government by a license, to be renewed annually, similar to that required by solicitors. The public would soon learn the difference between a "qualified" chemist and a "non-qualified" one, and the latter race would die out utterly in a brief space.

The series of diplomas for chemistry might thus stand when placed in juxtaposition to their equivalents in medicine:—

Chemistry.		Medicine.	
University of London.	Sc.D. Sc.B.	University of London.	M.D. M.B.
Royal College of Chemists.	F.R.C.C. M.R.C.C.	Royal College of Physicians or Surgeons.	F.R.C.P. or S. M.R.C.P. or S.

Possibly a greater variety of diplomas would hardly be necessary, but that is a mere matter of detail.

There still remains a question of some considerable interest and difficulty which would have to be solved, namely, what to do with those chemists who have justly earned a position and a reputation, but who have not either degree of the University of London. Should they be granted an honorary degree, say of M.R.C.C.? Should they all be made to pass a full examination? Should they be "admitted" on passing a modified examination? In the first or third case who should decide which of the persons calling themselves chemists were worthy of the honorary diploma, or of admisson on passing a modified examination?

Can we not hold a provisional meeting, say at the Scientific Club, to discuss our projects and our prospects.—I am, &c.,

Charles H. Piesse.

303, Strand, London, March 11, 1876.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences. No. 8, February 21, 1876.

Rotatory Power of Styrolen.—M. Berthelot.—The author announces that in consequence of the paper by M. van't Hoff he has repeated his experiments with pure material, volatile at 147°, and agreeing on analysis with the formula $C_{16}H_8$. The rotatory power, with reference to the sodium light, was found—

First specimen .. .. $a_D = -3{\cdot}1°$
Second specimen.. .. $a_D = -3{\cdot}4°$

The slight difference he considers due to the formation of a little inactive styrolen during the rectification.

Coefficient of Dilatation of Air under Atmospheric Pressure.—M. Mendeleeff and Kaiander.—A mathematical paper, not adapted for abstraction.

Certain Remarkable Points in Magnets.—M. Jamin.—If a very short magnetic needle, supported at its centre of gravity, is moved near the surface of a magnet the

direction of this needle is seen to vary at the same time as the co-ordinates of its centre of rotation. Among these directions there are some deserving attention, those which are normal to the surface of the magnet. The author terms the points with which they correspond the orthogonal points, and finds that they possess the following properties:—If in an orthogonal point we place a small magnetic body, in order to remove it from its place to an infinite distance more mechanical power is required than if it had been placed on any other adjoining point of the surface of the magnet. Another curious property is as follows:—The positions of spontaneous equilibrium of a small magnetic body with relation to a magnet are exactly the orthogonal points.

Composition of the Black Matter obtained on Calcining the Ferrocyanide of Potassium.—M. A. Terreil.—This substance is not a carbide of iron of definite composition, but a mixture containing finely-divided iron in the state of cast-iron, magnetic oxide of iron, free carbon, and a small amount of cyanide of potassium, which cannot be removed by washing.

Formation of Anhydrous Acids of the Fatty and of the Aromatic Series by the Action of Phosphoric Acid upon their Hydrates.—MM. H. Gal and A. Etard.—If the acid is mixed in a retort with anhydrous phosphoric acid, the phosphoric acid turns slightly brownish, and the mixture heats. On rapid distillation the anhydrous acid passes over.

Products of the Action of Chloride of Lime upon the Amines.—M. J. Tschermak.—Not adapted for abstraction.

Bulletin de la Société d'Encouragement pour l'Industrie Nationale. No. 26, February, 1876.

Report made by M. Lamy, on behalf of the Committee of Chemical Arts, on the "Tank Apparatus" for Concentrating Sulphuric Acid to 66° B., Designed by MM. Faure and Kessler.—This invention has been already noticed (see CHEM. NEWS, vol. xxxiii., pp. 55, 95).

Note on Charcoals used for Decolourising, their Artificial Production, and the Regeneration of Blacks Employed in the Arts.—M. Melsens.—The author has made a series of comparative experiments on the absorption and condensation of dissolved bodies, including colouring matters from an industrial point of view. He considers that chemically pure charcoals have no decolourising action. Bone-black, or animal charcoal, is solely employed in the arts, as it has a well-marked power of absorbing either colouring matters, or salts of lime, and any excess of lime contained in saccharine liquids. The high price of bone-black has led to many attempts to find a substitute, but these experiments have not been successful. The author doubts whether the decolourising action of bone-black is purely physical, as commonly supposed, and suggests that chemical processes may also be concerned.

Moniteur Scientifique, du Dr. Quesneville, February, 1876.

Analysis of Mixtures of Mono- and Bicarbonates.—A. Mebus.—Two equal portions of the mixture are weighed out, and in one of them the total alkali is determined by means of a standard acid. Into the solution of the other portion is poured a standard solution of caustic soda, perfectly free from carbonic acid, and corresponding in quantity with the alkali just found to be present,—*i.e.*, as many equivalents of alkali are added as are already contained. Of the alkali thus added, one portion combines with half the carbonic acid of the bicarbonate, and the remainder—which is precisely equal in quantity, or equivalent (according as the base added is identical with or different from the base of the salts under examination) to the alkali of the monocarbonate—remains in a free state in the liquid. This solution is then precipitated with an excess of chloride of barium; the carbonates are thus eliminated as carbonate of baryta, and after filtration there remains in the filtrate merely the excess of chloride of barium, chloride of sodium, and a quantity of free caustic soda equivalent to the alkali of the monocarbonate. All that remains is to take a known fraction of this liquid, and determine the alkali in the usual manner. We have thus the alkali of the monocarbonate, and by subtracting it from the total alkali we find the alkali of the bicarbonate.

New Method for the Volumetric Determination of Silver.—J. Volhard.

Determination of Chlorine, Bromine, and Iodine in Organic Compounds.—E. Kopp.—The author takes a tube, 60 c.m. long and from 5 to 6 m.m. in internal diameter, and closes one of its ends at the lamp. To regulate more easily the decomposition of the organic matter it is mixed with pure oxide of iron, prepared by calcining the crystalline sulphate. This mixture is introduced without letting it heap up in the tube, where it ought to occupy a portion of 12 to 18 c.m. in length. The tube is rinsed with pure oxide of iron, which is introduced after the mixture. A number of narrow coils of very fine iron wire are then introduced, occupying from 20 to 25 c.m., and the rest of the tube is filled up with porous crusts of anhydrous carbonate of soda. The part of the tube containing the wire coils is heated first, and the heat is then gradually extended towards the closed end, till that has been reached. At this temperature the organic matter is decomposed by the peroxide of iron and any portions which may be volatilised by the red-hot spirals. In whatever form the chlorine, bromine, or iodine is disengaged it is arrested by the red-hot iron, forming with it the sparingly volatile compound $FeCl_2$, $FeBr_2$, or FeI_2. Traces of Fe_2Cl_6, Fe_2Br_6, &c., are arrested by the alkaline carbonate. After cooling, the tube is cleaned externally, broken over a sheet of paper, and the fragments placed in a flask containing a little distilled water, which is raised to a boil. The chlorides, bromides, and iodides are decomposed by the alkaline carbonate. It is filtered, washed, the filtrate acidified with nitric acid and precipitated with nitrate of silver. In most cases the total volume of the liquid does not exceed 40 c.c.

Detection of Oil of Turpentine or of Rosemary in Oils for Lubricating Machinery.—M. Burstynn.—The oil is shaken up with an equal volume of alcohol at 90 per cent. This dissolves a very small quantity of oil and any free fatty acids. If the essences of turpentine or rosemary are present, they also are chiefly taken up. After standing for some hours the oil and the alcoholic liquid are completely separated, and the latter, which forms the upper stratum, may be drawn off by means of a syphon. It contains the fatty acids and the essences. This mixture is distilled in the water-bath, the essences are carried along by the vapour of alcohol, and are found chiefly in the first portion of the distillate collected. The fatty acids and the oil dissolved remain in the retort. The presence of the essences in the distillate is easily shown. If the quantity of the essence in the alcohol is not less than 0·1 per cent in volume, the liquid becomes turbid on dilution with water. If the proportion is smaller, the liquid remains clear. In this case, if we add to the diluted solution a few drops of sulphuric acid, a very distinct rose-red colour is produced where the two liquids come in contact. If the essential oils are present in quantity, the sulphuric acid forms a rose-coloured stratum at the bottom of the test-tube.

Determination of the Quantity of Acid contained in Fatty Oils.—M. Burstynn.—Into a test-glass with a foot, and fitted with a ground stopper, pour equal measures of the oil and of alcohol, at 88 to 90 per cent. Stopper, shake well, and let settle. After two or three days the alcohol forms a perfectly clear supernatant stratum, containing the free fatty acids and a little oil: 25 c.c. of this

alcoholic solution are taken out with a pipette. A few drops of an alcoholic solution of turmeric are added, and the liquid is titrated with a normal solution of caustic potassa. The number of c.c. of the solution of potassa employed, multiplied by 4, shows how much of the alkaline liquid is required to neutralise the free acids in 100 c.c. of the oil. As the acidity of the oil is due not to one acid, but to a mixture, the result thus obtained cannot be calculated into weight. The number found, however, enables us to calculate what weight of any of the acids present is equivalent to the total acidity of the mixture.

Ferments and Fermentations.—C. Blondeau.—Not suitable for abstraction.

History of the Manufacture of Turkey-red.—Theodore Chateau.—A continuation of the memoir commenced in the January issue.

Note on Explosive Compounds.—P. Champion and H. Pellet.—Already noticed.

March, 1876.

Progress of the Manufacture of Artificial Colouring Matters.—Ad. Wurtz.—An extract from the fifth volume of the Report of the French Commission at the Vienna Exhibition.

New Explosive Agents.—Alfred Nobel.—A Lecture delivered before the Society of Arts.

History of the Manufacture of Turkey-Red (continued).—Theodore Chateau.—A lengthy historical survey, into which want of space forbids us to enter.

Reimann's Farber Zeitung,
No. 7, 1876.

A Forgotten Colour.—The simple decoction of onion-peel is said to produce upon glove-leather an orange-yellow superior in lustre to any other. It is also said to be suitable for mixing with light bark shades, especially willow bark, and as a yellow for modulating browns. The onion-dye is said to fix itself readily, even upon leathers which resist colours, and covers them well and even. Dr. Reimann seems, however, almost as sceptical of the tinctorial power of onions as of truffles.

Bulletin de la Societe Chimique de Paris,
No. 4, February 20, 1876.

Third Memoir on Albumenoid Bodies.—(Conclusion.) M. P. Schützenberger.—This voluminous essay is quite unfit for abstraction.

Products of the Action of Chloride of Lime upon the Amines.—M. J. Tschermak.—The author examines the action of chloride of lime upon hydrochlorate of ethylamin; describes the preparation, properties, and constitution of dichlor-ethylamin, and its behaviour with zinc-ethyl.

Composition of the Gases Derived from the Combustion of Pyrites.—M. A. Scheurer-Kestner.—A reply to M. Bode's critique (*Polytech. Journ.*, November, 1875, 322) on the author's former paper on this subject (*Bulletin de la Soc. Chimique*, xxiii., p. 437).

Volatile Oil of Storax.—M. J. H. van't Hoff.—The author finds that this oil is lævogyrous; that the optical activity is not due to styrolen, and that the identity of this body with cinnamon maintained by Kopp is not refuted by the researches of Berthelot. Volatile oil of storax contains a body of great optical activity ($-30°$ at least), and of a formula approaching $C_{10}H_{18}O$. This body is only present in storax to the extent of one-twentieth per cent.

Swedish Correspondence.—M. Cleve.—This consists of notes on the action of chlor-oxy-carbonic ether upon amidophenol, by M. E. Groenvik; on the derivatives of the biliary acids, by M. J. Lang; on the formation of fibrin, by M. Olof Hammarsten; on the spectra of the metalloids, by MM. Angström and Thalen; and on the mercaptides and certain sulphides of ethyl, by M. P. Clæsson.

Les Mondes, Revue Hebdomadaire des Sciences,
No. 8, February 24, 1876.

This issue contains no chemical matter.

No. 9, March 2, 1876.

A paragraph on eosin describes it as a new orange colour.

MISCELLANEOUS.

Asbestos Powder.—Asbestos powder, made into a thick paste with liquid silicate of soda, is used with great advantage for making joints, fitting taps, and connecting pipes, filling cracks in retorts, &c. It will be found to be of great service in the manufacture of nitric acid, sulphuric acid, and other products, because it can be employed in a very easy way; it hardens very quickly, stands any heat, and prevents the escape of acid vapours. Mr. John Casthelaz informs us that he has used it for about twenty years, but he recently found that its use for the above purposes was unknown to several prominent manufacturing chemists. They have since adopted it, and are highly satisfied with the result.

The Visit of the Fellows of the Chemical Society to the Royal Arsenal.—A special train conveyed Prof. Abel's guests to and from the Woolwich Arsenal on Tuesday last, and the whole of the arrangements, from whatever point they may be viewed, were in the highest degree successful. About 450 Fellows of the Society were present. An hour and a half was spent in the Laboratory, Carriage Department, and Gun Factory. Then came the firing of the 80-ton gun. The first trial was made with a charge of 220 lbs., and the second with a charge of 230 lbs., the shot weighing 1265 lbs. The first experiment gave a muzzle-velocity, as observed by the chronoscope, of 1546 feet per second, the mean internal pressure on the gun being 23·3 tons per inch. In the second trial the velocity only reached 1536 feet, notwithstanding the additional 10 lbs. of powder employed, the slight diminution in speed being due to the additional length and looser packing of the powder cartridge in this instance. By this arrangement the internal pressure was reduced to 18·9 tons, as compared with the former result of 23·3 tons—showing that, at a comparatively small sacrifice of speed, considerably less strain was put upon the gun. The powder used consisted of 1·7-inch cubes, previous trials having established the superiority of this size over the 2-inch cubes recently employed. This was followed by three series of experiments on Detonation and its Applications, a subject which Prof. Abel may almost be said to have made his own. The first series illustrated the conditions which promote detonation of an explosive agent by a blow, or by the force exerted by an initial detonation. A fuze containing 30 grms. of gunpowder strongly confined and exploded in contact with a mass of compressed gun-cotton only inflamed and dispersed it, a similar effect only being produced by 3 grms. of unconfined mercuric fulminate—a powerfully explosive compound. But a fuze containing 0·6 of the latter material in a strongly confined state immediately produced detonation. It was thus made apparent that the explosion of the gun-cotton was dependent on the sharpness and quality of the initial detonation, as well as upon the resistance to mechanical dispersion offered by its own mass. Still more striking experiments on this head were the detonation of 10 grms.

of compressed gun-cotton in proximity to dynamite—producing immediate explosion of the latter—and the detonation of 80 grms. of dynamite in actual contact with compressed gun-cotton, which merely suffered dispersion. The second series of experiments bore upon the transmission of detonation through varying masses of compressed gun-cotton, and the means of scientifically computing its rate under certain circumstances, the third series being devoted to some illustrations of sundry practical applications of the same material. Thus a wrought railway-iron was shivered by the firing upon its surface of about 8 ozs. of this substance, a similar fate being shared by a large granite block. In the latter case, however, the interest lay in the fact of the destruction of the block by a wet mass of perfectly uninflammable gun-cotton, detonated by the firing on its surface of a comparatively trifling charge of the same body in a dry state. The interesting experiments in the Royal Gun-Factories included the formation of the outer coil of a 38-ton gun, the welding under the 40-ton hammer of an exterior 80-gun coil, and the "shrinking" of the trunnion-coil on to a 38-ton gun. Some "rolling-mill" work was also shown before the building was quitted. The final display was the run of the "Whitehead," or "Fish" torpedo (self-propelled by means of compressed air) in the canal of the Arsenal. Luncheon was provided for the visitors; after which Dr. Hooker, F.R.S., in appropriate terms, proposed the health of the host.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

Improvements in gas or hydraic engines, heated by heat generated by chemical action igniting hydrogen and oxygen gases to form water. P. Vera, Kensington Garden Square, Bayswater, Middlesex. January 16, 1875.—No. 175. My invention consists of a process and apparatus for generating heat and motion, by causing the explosion of a mixture of hydrogen and oxygen gases in the proportions for forming water, and utilising the heat generated, thereby to convert the water so formed into steam, also to heat air to a high temperature with the steam produced in order to serve as a motor like steam serves, and also using the electricity generated by the oxygenation of the hydrogen for decomposing water to obtain hydrogen and oxygen gases to add to the supply of gases for the same machine.

Improvements in the manufacture of phosphate of iron, and its application to the preparation of alkaline phosphates, and to the extraction of phosphorus. J. Box, Great George Street, Westminster, E. Aubertin, L. Bobinque, and H. Leplay, Paris. January 16, 1875.—No. 181. Phosphate of lime is dissolved in hydrochloric or other acid, and oxide of iron is also dissolved in similar acid; the two solutions thus prepared are mixed, the insoluble matter from each is removed, and the excess of acid saturated with carbonate of lime, a precipitate of phosphate of iron is formed, which is employed in the manufacture of ammoniacal salts; also the preparation of alkaline phosphate by a wet and dry process as described.

A certain new and useful process in the production of glossiness, and the application of mordants and dyes to vegetable textiles. J. B. Kuenemann, Leicester Square, Middlesex. (A communication from P. Magner and E. Kunemann, M.D., both of New Orleans, United States of America.) January 16, 1875.—No. 194. According to this Provisional Specification the textile material is converted into cellulose, and it is deoxidised preparatory to mordanting and dyeing.

Improvements in apparatus and means for utilising petroleum and other hydrocarbon liquids in lieu of coal or other fuel. O. C. D. Ross, C.E., Craven Street, Strand, Middlesex. January 19, 1875.—No. 197. This invention mainly relates to a stoking vessel termed a "carburetter" constructed with several orifices, through one of which atmospheric air is to be drawn or driven, and through such one of the others as may be selected by the operator it will emerge more or less saturated with hydrocarbon vapour in a state in which it is inflammable. This carburetter should be partitioned interiorly as to allow of the current of air passing over the surface of the liquid in a long and continuous current, and the channel in which the air is confined should be capable of regulation so as to admit more or less vapour. Various subsidiary details are given. In lieu of atmospheric air gases of an inferior quality are employed, such as poor coal-gas, wood-, or peat-gas, decomposed steam, carbonic acid or oxide, more or less diluted with nitrogen or other vapours.

Certain compounds for dissolving resins and gum-resins, and for other purposes for which alcohol or methylated spirit is now employed. Murdock Mackay, practical chemist, Mark Street, Finsbury, Middlesex. January 19, 1875.—No. 200. Adding to methylated spirit one or other of two certain combinations hereinafter stated, or a certain article hereinafter stated, and stirring till the mixture becomes opaque or turbid, and then adding more methylated spirit till it becomes clear. The combinations are termed No. 1 and No. 2. No. 1 consists of 1 part of benzoline to 6 parts of mineral or coal naphtha, or 1 part of turpentine to 6 parts of mineral or coal naphtha; or half one part of benzoline and half one part of turpentine may be substituted for one whole part of either. No. 2 consists of 1 part of turpentine to 3 parts of benzoline. The said certain article is benzoline, which is employed in the proportion of 1 part of benzoline to 3 of methylated spirit, or any other hydrocarbon (employed in suitable proportions) may be substituted for benzoline. Instead of combination No. 1 mineral or coal-tar naphtha may sometimes be employed. The proportions stated may be varied.

An improved process for preserving vegetable and animal substances. W. R. Lake, Southampton Buildings, London. (A communication from J. R. McClintock, New Orleans, United States of America.) January 19, 1875.—No. 207. This invention relates, first, to the dry fumigation of the articles to be preserved by subjecting them to the action of the gases or fumes generated from a compound of powdered sulphur and charcoal; after the process of dry fumigation has been completed, the said articles or articles must be submerged in water thoroughly impregnated with the gas or vapour generated from the same compounds.

NOTES AND QUERIES.

*** Our Notes and Queries column was opened for the purpose of giving and obtaining information which may be of use to our readers generally. We cannot undertake to let this column be the means of transmitting merely private information, or such trade notices as shall illegitimately come in the advertising columns.

Treatment of Woollen Waste.—Would Mr. Allen, of Sheffield, kindly inform me what are the chemical reagents used, and in what proportions in the treatment of woollen waste (shoddy) for the manufacture of manure?—Guillermo Prossorio.

MEETINGS FOR THE WEEK.

Monday, 20th.—Medical, 8.
—— London Institution, 5.
—— Society of Arts, 8. Cantor Lectures. "Wool Dyeing," by George Jarmain.
Tuesday, 21st.—Civil Engineers, 8.
—— Zoological, 8.30.
—— Royal Institution, 3. "On the Classification of the Vertebrated Animals," by Prof. Garrod.
Wednesday, 22nd.—Society of Arts, 8. "Railway Couplings," by P. A. Brodebank.
—— Geological, 8.
Thursday, 23rd.—Royal, 8.
—— Royal Institution, 3. "Polarised Light," by Mr. Spottiswoode.
Friday, 24th.—Royal Institution, 9. "Geological Measure of Time," by Prof. McK. Hughes.
—— Quekett Microscopical Club, 8.
—— Society of Arts, 8. India Section. "The Land Revenues of India," by Major-General Marriott C.S.I.
Saturday, 25th.—Royal Institution, 3. "Human Senses," by Prof. Robertson.
—— Physical, 3.

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THE CHEMICAL NEWS.

VOL. XXXII. No. 832.

ON REPULSION RESULTING FROM RADIATION.*

By WILLIAM CROOKES, F.R.S., &c.

PART III.

THIS paper contains an account of experiments on the action of radiation on bodies the surfaces of which have their radiating and absorbing powers modified by various coatings. The difference between a white and a lamp-blacked surface in this respect was at first not very decided, and experiments have been instituted with the object of clearing up some anomalies in the actions observed. Two pith discs, one white and the other black, are suspended on a light arm in a glass bulb by means of a fine silk fibre; after perfect exhaustion the white and black discs are found to be equally repelled by heat of low intensity, such as from the fingers, warm water, &c. A copper ball is then tried at gradually increasing temperatures. Up to 250° C. it repels both equally, above that the black is more repelled than the white, and at a full red heat the repulsion of the black disc is very energetic. A lighted candle acts with more energy than the red-hot copper.

The presence of even a small quantity of aqueous vapour in the exhausted apparatus almost, if not quite, neutralises the more energetic action which luminous rays appear to exert on a blackened surface.

After describing several different modifications and some new forms of apparatus devised to facilitate experiment, the author gives a drawing of an instrument which enables him to get quantitative measurements of the amount of incident light falling on it. It consists of a flat bar of pith, half black and half white, suspended horizontally in a bulb by means of a long silk fibre. A small magnet and reflecting mirror are fastened to the pith, and a controlling magnet is fastened outside so that it can slide up and down the tube, and thus increase or diminish sensitiveness. The whole is completely exhausted and then inclosed in a box lined with black velvet, with apertures for the rays of light to pass in and out. A ray of light reflected from the mirror to a graduated scale, shows the movements of the pith bar. The degrees of deflection produced by the light of a candle at distances from 6 feet to 35 feet are given.

The experimental observations and the numbers which are required by the theoretical diminution of light with the square of the distance, are sufficiently close, as the following figures show:—

Candle	6 feet off	gives a deflection of	218·0°
,,	12	,, ,,	54·0°
,,	18	,, ,,	24·5°
,,	24	,, ,,	13·0°
,,	10	,, ,,	77·0°
,,	20	,, ,,	19·0°
,,	30	,, ,,	8·5°

The effect of two candles side by side is practically double, and of three candles three times that of one candle.

The action of various solid and liquid screens is next given.

A candle three feet off, giving a deflection of 180°, has its action reduced to the following amounts by—

Yellow glass	161°
Blue ,,	102°
Green ,,	101°
Red ,,	128°
Water	47°
Alum	27°

* Abstract of a paper read before the Royal Society, Feb. 10, 1876.

A candle on each side of the apparatus, and equidistant from it, keeps the index ray of light at zero; by shading off either one or the other the light flies off to either extremity of the scale. This gives a ready means of balancing two sources of light one against the other. Thus, retaining the standard candle 48 inches off, on the left of the bar, the index is brought to zero by placing on the right

2 candles	67 ins. off.
1 candle behind solution of sulphate of copper	6 ,,
,, ,, alum plate	14 ,,
A small gas burner	113 ,,

These experiments show how conveniently and accurately this instrument can be used as a photometer. By balancing a standard candle on one side against any source of light on the other, the value of the latter in terms of a candle is readily shown; thus, in the last experiment the standard candle 48 inches off is balanced by a gas-flame 113 inches off. The lights are therefore in the proportion of 48^2 to 113^2, or as 1 to $5\frac{1}{4}$. The gas-burner is therefore equal to $5\frac{1}{4}$ candles.

By interposing screens of water or plates of alum, and so cutting off the dark heat, the actual luminosity is measured. In addition to this, by interposing coloured glasses or solutions, any desired colours can be measured either against the total radiation from a candle, its luminous rays, or any desired colour. One coloured ray can be balanced against another coloured ray, by having differently coloured screens on either side.

The variations in the luminosity of a "standard" candle will cease to be of importance. Any candle may be taken; and if it be placed at such a distance from the apparatus that it will give a uniform deflection, say of 100 divisions, the standard can be reproduced at any subsequent time; and the burning of the candle may be tested during the photometric experiments by taking the deflection it causes from time to time, and altering its distance, if needed, to keep the deflection at 100 divisions.

If the pith bar in this instrument be blacked on alternate halves, an impetus given by a ray of light always acts in the same direction of movement. A candle causes it to spin round very rapidly until the suspending fibre is twisted up, and the rotation is stopped by the accumulated torsion.

By arranging the apparatus so that the black and white surfaces are suspended on a pivot instead of by a silk fibre, the interfering action of torsion is removed, and the instrument will rotate continuously under the influence of radiation. To this instrument the author has given the name of the "Radiometer." It consists of four arms of very fine glass, supported in the centre by a needle-point, and having at the extremities thin discs of pith lamp-blacked on one side, the black surfaces all facing the same way. The needle stands in a glass cup, and the arms and discs are delicately balanced so as to revolve with the slightest impetus.

In the *Proceedings of the Royal Society* last year, the author gave a brief account of some of the earlier experiments with these instruments. In the present paper he enters very fully into the various phenomena presented by them, and gives Tables showing the number of revolutions made by the radiometer when exposed to a constant source of light removed different distances from the instrument. The law is that the rapidity of revolution is inversely as the square of the difference between the light and the instrument.

When exposed to different numbers of candles at the same distance off, the number of revolutions in a given time are in proportion to the number of candles, two candles giving twice the rapidity of one candle, and three, three times, &c.

The position of the light in the horizontal plane of the instrument is of no consequence, provided the distance is not altered; thus two candles, one foot off, give the

same number of revolutions per second, whether they are side by side or opposite to each other. From this it follows that if the radiometer is brought into a uniformly lighted space it will continue to revolve. This is proved to be the case by experiment.

The speed with which a sensitive radiometer will revolve in full sunshine is almost incredible. Nothing is visible but an undefined nebulous ring, which becomes at times almost invisible. The number of revolutions per second cannot be counted, but it must be several hundreds, for one candle will make it spin round forty times a second.

The action of dark heat (*i.e.*, from boiling water) is to repel each surface equally, and the movement of the radiometer is therefore arrested if a flask of boiling water is brought near it. The same effect is produced by ice.

From some observations made by the author, it appears probable that heat of a still lower refrangibility repels the white more than it does the black surface. Many instances are given of the radiometer revolving the reverse way. Thus, breathing gently on the instrument will generally cause this effect to be produced.

An experiment is described with a radiometer, the moving parts of which are of aluminium, blacked on one side. When exposed to the radiation from a candle, the arms revolve the normal way. On removing the candle they revolve the reverse way. Heated with a Bunsen burner the arms revolve the normal way as they are getting hot, but as soon as the source of heat is removed and cooling commences, rotation sets up in the reverse way, and continues with great energy till the whole is cold. It appears as if the reverse movement during the cooling is equal in energy to the normal movement as it is being heated.

It is easy to get rotation in a radiometer without having the surfaces of the discs differently coloured. An experiment is described with one having the pith discs blacked on both sides. On bringing a candle near it, and shading the light from one side, rapid rotation is produced, which is at once altered in direction by moving the shade to the other side.

The author describes many forms of radiometer, by means of which the movements can be exhibited to a large audience, or can be made to record themselves telegraphically on a self-recording instrument.

A STUDY OF HYDROCARBONS.

II. Alizarin and Dibasic Compounds.

By S. E. PHILLIPS.

(Continued from page 38.)

The skeleton or mere dictionary character of the Tables referred to would be incomplete without a generic appendix, whose object should be to succinctly epitomise the leading characters of generic groups.

What is a quinon, a pinacolin, a urethan, or urethylan? would here find answers in brief funeral notices; while acids, aldehyds, alcohols, &c., might be enlarged to embrace separate categories.

It might be well to give some account of the generic origin of the tribasic acids; but while very much is done with "hydroxyl" dispositions, and M. Richter exults in a molecular omniscience, which gives a marvellous insight and a delightful pleasure to the architect of that pleasantry, yet I must confess to an utter ignorance of the subject.

The generic production of the infinitude of ordinary acids is well provided for in the Tables referred to, but no place whatever is assigned for the succinic group of acids. I deeply regret this, but deem it well to make the confession.

While the fatty acids are universally considered *monobasic*, it is not a little curious that some chemists should—on the most slender grounds—invent for them fancied types of *ortho* or tribasic peculiarity, while the succinic groups are persistently regarded as dibasic.

That view necessitates that the radical or acid group should contain an even number of H atoms, which I hold to be a violation of all analogy, and quite incapable of proof.

If ethylen ammonia is represented as $(C_4H_3)H_2N$,
No! says diatomic hypothesis, it is $(C_4H_4)''HN$.

With a limited number of facts it might be difficult to decide between the two alternatives; but now that knowledge is extended it is easy to see that, in many cases, all the H atoms of ammonia are similarly replaceable, while with the diatomic or triatomic groups no such action is at all possible (see "Citric Acid," vol. xxvii., p. 109).

Notwithstanding the great reluctance evinced to fairly estimate the true character of the nitrile radicals, yet it is well that the propargyl hydride, C_6H_3,H, has been well and definitely established in its corresponding relations with ethane; and now it is further seen that propargylen, C_6H_2,H, has similar relations, and that its behaviour strictly corresponds with acetylen, C_4H_2,H!

M. von Lang states that the sulphates of ethylendiamine and platino-diamine are isomorphous: they contain the elements of—

$$PtH_6N_2O.SO_3,$$
$$(C_4H_3)H_6N_2O.SO_3.$$

That the succinic group of acids are tribasic is well evidenced in their ammonia types, in their sulpho-acid salts, and in their varied substitutional condensations.

The amides, anilides, or other ammonia forms, are very various, but all are consistent with the simplest amide forms.

Succinic	anhydride	$+H_3N-2HO$	$=C_8H_3O_4.H_2N$
Malic	,,	,,	$=C_8H_3O_6.H_2N$
Tartaric	,,	,,	$=C_8H_3O_8.H_2N$
Malonic	,,	,,	$=C_6H_3O_4.H_2N$
Tartronic	,,	,,	$=C_6H_3O_6.H_2N$
Phthalic	,,	,,	$=C_{16}H_3O_4.H_2N$

These can be similarly derived from the normal acids, $-4HO$, but for such reactions the anhydrides are mostly preferred.

If acetic and succinic acids are separately digested with sulphuric acid there results—

Sulpho-acetic acid .. $HO,SO_2+C_4H_3O_2.O.SO_2$,

Or—

Sulpho-succinic acid $3HO,SO_2+C_8H_3O_4,O.SO_2$.

The laws of condensation testify to the same result and we may have an ethyl or a succin-succinic acid.

$$\text{Alcohol} + \text{succinic acid} - 2HO = \left\{\begin{matrix}C_8H_2O_4\\C_4H_5\end{matrix}\right\} = C_{12}H_7O_4,O.3HO$$

$$\text{Acid} + \text{acid} - 2HO = \left\{\begin{matrix}C_8H_2O_4\\C_8H_3O_4\end{matrix}\right\} = C_{16}H_5O_8,O.5HO$$

the only difference in the radicals being that in one case ethyl replaces one H, whereas in the other succinyl replaces one H!

Ditartaric and benzo-tartaric acids are quite parallel, and these condensations may be traced in many ways with only one consistent result.

It is curious to notice the varied shades of confusion ever subsisting with the diatomic ethylen, and it is quite clear that "ethylen succinic acid" is truly a "glycol succinate,"—

$$\text{Glycol} + \text{succinic acid} - 2HO = \left\{\begin{matrix}C_8H_2O_4\\C_4H_5O_2\end{matrix}\right\} = C_{12}H_7O_6,O.3HO.$$

It is produced by digesting glycol with succinic acid at 150° C.; but if the temperature be raised to 300° C., then the anhydride results $C_{12}H_7O_6,O.HO$.

A dicetylo-succinate has been obtained—

$$\left.\begin{matrix} C_8H_1O_4 \\ C_{32}H_{33} \\ C_{32}H_{33} \end{matrix}\right\} = C_{72}H_{67}O_4.0.3HO.$$

Glycol alcohol = $(C_4H_5O_2)_1O.HO$
Ethyl ,, = $C_4H_5.O.HO$
Cetyl ,, = $C_{32}H_{33}O.HO$.

We now pass on to a wider consideration of alleged diatomic behaviour.

As in mineral chemistry we have the alums and other double saltic types, so in organic chemistry the same play of forces between − and + salts subsists in greater variety, the double sulphates being called sulpho-salts,—the double carbonates carbo-salts, &c. As typical of the whole we may state that—

Sulpho-salts are considered monobasic,
Di- ,, ,, dibasic,
Tri- ,, ,, tribasic.

This may be really so, but I cannot accept it without fuller evidence and a better explanation.

There are many considerations which point in a contrary direction, and the limits of this paper only admit of a glance at some of these. At the onset it is a very suspicious circumstance that such bi-bases (?) often occur with salts of admitted mono-acids.

If we tabulate a long list of sulpho-hydro-cinnamates we find they consist of alleged acid and neutral salts.

All the acid salts conform to the type—

$$HO,SO_3.C_{18}H_9O_2.O.SO_3.$$

For a long time the others have been a standing enigma, as if they contained the elements of—

$$2HO,SO_3.C_{18}H_9O_2.SO_3.$$

I knew that some acids were under these circumstances either di- or tri-basic, but this was not one of them; and that if acetic acid would give a certain type of salt, or amide, &c., that hydro-cinnamic acid would act similarly.

We now regard tartar emetic as—

$$C_8H_3O_8.O.SbO_3 = -(H_2K),$$

because it so happens that the water of crystallisation is expelled at 212° F., while at 400° chemists have been puzzled by the anomalous result, viz.,—

$$(C_8H_2O_8)KO.SbO_3,$$

which is tartar emetic when dissolved in water. In such case we have the elements of a tartryl radical, minus one H, and minus the necessary O! Let K replace the missing H, the O is then provided, and we have a normal tribasic tartrate!

As a remarkable instance, and a feasible illustration that the type need not necessarily alter by metallic substitution, we cite a sulpho-ammoniacal condensation:—

$KO,SO_3.HO,SO_3$ with $KO,S\,O_3.H_4$ $NO.S\,O_3 - 2HO =$
$KO,S_2O_5.H_3K$ $NO.S_2O_5 - 2HO =$
$KO,S_3O_8.H_2K_2NO.S_3O_8 - 2HO =$
$KO,S_4O_{11}.H\ K_3NO.S_4O_{11}.$

Similar condensations occur with the mono-, di-, and tri-sulpho salts of methyl, phenyl, &c., but they have a special interpretation of di- or tri-atomic hypothesis.

When Kekulé and Franchimont synthesised "triphenyl methane," it took shape and character from the special point of view. Some interpreted these hydrocarbons as benzol derivatives, but they preferred a genesis from the fatty acid bodies—

Triphenyl methane .. $CH(C_6H_5)_3$
The sulpho-acid .. .. $CH(C_6H_4SO_3H)_3$,

but subsequently I find it yields "a true carbinol,"—

$$(C_6H_5)_3C.OH - C_{38}H_{15}.O.HO,$$

and the triatomic peculiarities vanish in the inevitable future result.

Methane is.. .. .. C_2H_3, H
Triethyl methane *by genesis* is.. C_2E_3, $H = C_{14}H_{15},H$
Triphenyl methane .. .. .. $C_2Ph_3,H = C_{38}H_{15},H$,

	Acids.	Salts.	Amides.
Acetic acid	$C_4H_3O_2,O.HO$	$C_4H_3O_2,O.MO$	$C_4H_3O_2H_2N$
Hydro-cinnamic acid	$C_{18}H_9O_2,O.HO$	$C_{18}H_9O_2,O.MO$	$C_{18}H_9O_2H_2N$, &c.

Many chemists have none of these misgivings: they can as easily notate such an acid with ($C_{18}H_8$) as with ($C_{18}H_9$), and may even prefer it, as more like the favourite ethylen.

The secret of all this now stands revealed in the tendency of some reactions, and especially with some hydrocarbons, to a metallic substitution in the radical. This tendency is most strongly manifested in certain nitrile or aldehydic hydrocarbons, with a diminished proportion of H,—with acetylen, propargylen, and bodies of that character, copper or some other metal seems almost as normal as the H itself!

This subject has engaged much attention in a prolonged study of urea and ureide condensations, to the following result:—"We therefore sweep away all the tribasic cyanurates, glycollamates, and an infinity of others. They have long been a perplexity and a stumbling-block; but the positivity of the enunciations, conjoined with a paucity of the means of research, have kept a humble amateur in restless suspense. We now take confidence in the perception so long desired, that hosts of di- and tri-basics can be explained and cleared away, in the recognition of a simple mono-law of saltic combination."

The truth is that such bodies are no salts at all, but metal amides; and a great want of discrimination has tended to needlessly confuse a very complex subject. As well might we say that zinc amide, ZnH_2N, is a monobasic salt, and Zn_2HN a diabasic salt, &c. Such considerations may enable us to penetrate a mystery in regard to tartar emetic, which has puzzled many.

That acid contains the elements of $C_8H_3O_8,0.3HO$
The ordinary saltic forms .. .. $C_8H_3O_8,O.2MO,HO$
Tartar emetic .. .. $C_8H_3O_8,O.SbO_3,KO,HO$

and all three are, *by fact and behaviour*, hydrocarbons in common with all others, and equally defiant of special hypothesis.

The first gives a mono-acid, $HO,S\,O_2.C_2H_3,O.S\,O_2$
a di- $HO,S_2O_5.C_2H_3,O.S\,O_2$
a tri- $HO,S_3O_8.C_2H_3,O.S_3O_8$,

and similarly with the two others and all alike affecting metallic substitution in the radical, in proportion as the saltic condensation is pushed. As methane is not a triatomic body, so neither is either of its more complex derivatives or analogues. The association of triphenyl methan with its trisulpho acid, and their analogy of constitution, is either real or true or fancied and false! A proper survey of collateral facts very strongly suggests the latter alternative. We have—

Dinaphthyl methan, $C_2Np_2H,H = C_{45}H_{11}.H$
Triphenyl methan, $C_2Ph_3.H = C_{38}H_{15}.H$
Tetraphenyl methan, $C_2Ph_3,Ph = C_{50}H_{19},H$,

and while it may be well to take note of these genetic origins, as some clue to the explanation of isomeric peculiarities, yet the presumption is that these type representations are, in fact, a falsity, when used in any other sense, and that the latter substance is truly a hydride, like the two others.

Let it be shown that the dinaphthyl methan is diatomic, the triphenyl triatomic, and the tetramethan tetratomic, and we must submit to evidence. In the meantime we accept these hydrocarbons in the sense referred to in the Tables, and look for their oxide, sulphide, chloride, hydrate, acid, or ammonia derivatives, in common with all other hydrocarbons, quite irrespective of their individual specialities or of the isomeric genesis of their radicals.

Nonan, $C_{18}H_{19},H$, is a hydrocarbon possessing all these characteristics. It may be true that some of these hydrides are 1 vol, others 2 vols., and that their boiling-points differ in proportion as they may be derived from a di-, tri-, or tetra-substitution or condensation; but will any one have the hardihood to affirm that *the* nonan tetra-ethyl methan, $C_2E_3,E=C_{18}H_{19}H$, is in any way tetratomic?

Heptan (œnanthyl), $C_{14}H_{15},H$, boils at 99° C.,
The isomer "triethyl methan," 1 *vol.*, C_2E_3,H, boils at 96°,
The tetra-isomer, C_2E_2Me,Me, boils at 87°,

but in a very wide chemical sense they are all one heptan, in full possession of all the generic characteristics referred to.

We have two sulpho-anthracenic acids, –

The mono- .. .. .. $HO,SO_2.C_{28}H_9.O.SO_2$
The di- .. .. .. $HO,S_2O_5.C_{28}H_9.O.S_2O_5$.

but by the terms of the above hypothesis the second would not be anthracenic, and the anthracen-oxide must become $C_{28}H_8.SO_2$!

In sight of all this it is easy to understand how Dewar may have been misled in estimating the diatomic phenols, and then the transition is easy through a host of similars, and by the naphtha- and anthraquinons to alizarin—the special object of this enquiry.

Let us take hydroquinon as an illustration, and the allegation is that a monobasic sulpho-phenate, by oxidation with potash hydrate, becomes an oxy- or diatomic and dibasic phenol. C_6H_5,OH becomes $C_6H_4\begin{cases}OH\\OH.\end{cases}$

Of course all this is ingeniously ethylenic, but of such radicals as ($C_{12}H_4$), or of such hydroxyls, I have no evidence whatever, much less of the three hydroxyls of pyrogallol—

$$C_6H_3\begin{cases}OH\\OH\\OH\end{cases}$$

We hold that the same character and formula of oxidation which gives acetic acid from alcohol also gives quinon from phenol—

$$C_4H_5.O.HO+O_4-2HO=C_4H_3O_2.O.HO$$
$$C_{12}H_5.O.HO+O_4-2HO=C_{12}H_3O_2.O.HO,$$

and both acid results are really and strictly monobasic.

Whether the second be the actual quinon or one of its isomers does not at all concern us in this connection: in either case 2 of nascent H are assimilated to the production of a hydroquinon type, $C_{12}H_5O_2.O.HO$.

That glucose is an alcohol or hydrate has been proved by ammonia substitution, and other evidence of the completest character. Hence—

is nothing beyond an ingeniously devised numerical pleasantry.

The artificial synthesis of the alizarin type has been realised in several ways, but as the ratio of C to H is unusually large most formulæ require certain modifications to get the required result; and even then, as the valuable "Turkey red" is only one of many isomers, the practical difficulty is further enhanced. And why some of these bodies affect metallic substitution in the radical, while others do not, yet remains for further explication; but the great point—the all-essential consideration—is that the real constitution can be determined by an appeal to amide or sulpho-acid derivatives. Let an acid contain the elements of $C_{28}H_8O_8$, then, if diatomic (so-called), the amide would be $C_{28}H_5O_4,H_2N$; if monatomic, then it would be $C_{28}H_7O_6,H_2N$.

At the onset of this paper I had observed a great many anthraquinon and other derivatives, all leading inevitably to the conclusion that alizarin would evince the monoalternative; and while writing this the whole truth has been made manifest by chemical authorities of the highest standing.

Liebermann gives alizaramide $C_{14}H_9NO_3$, or amido-oxy-anthraquinon—

$C_{14}H_6O_2.NH_2.OH = C_{28}H_7O_6.H_2N$
The barium compound .. $C_{28}H_7O_6.H_2N$ –=(H6Ba)
Purpuramide .. .. .. $C_{28}H_7O_8.H_2N$.

I would not accept these as standing by themselves, because such elements may admit of another typical distribution; but as they are exactly what sound theory had pre-indicated, and as that high authority regards them as amides, it only remains to have the definite sulpho-acids of alizaric and purpuric acids for a final decision—the more so as Ladenburg had previously obtained the amine or hydrate form $C_{28}H_7O_6,H_3NO.HO$.

Alcohol + glucose – 2HO = Ethyl-glucose, $\left\{\begin{matrix}C_{12}H_{10}O_{10}\\C_4H_5\end{matrix}\right\}C_{16}H_{15}O_{10},O.HO$,

Hydrochinon + „ – 2HO = Arbutin, $\left\{\begin{matrix}C_{12}H_{10}O_{10}\\C_{12}H_5O_2\end{matrix}\right\}C_{24}H_{15}O_{12},O.HO$,

Saligenin + „ – 2HO = Salicin, $\left\{\begin{matrix}C_{12}H_{10}O_{10}\\C_{14}H_7O_2\end{matrix}\right\}C_{26}H_{17}O_{12},O.HO$,

Hydrochinon + 2 hydrochinon – 4HO = Pheno-quinon, $\left\{\begin{matrix}C_{12}H_3O_2\\C_{12}H_5O_2\\C_{12}H_5O_2\end{matrix}\right\}C_{36}H_{13}O_6,O.HO$.

Can anything be plainer than the similarity, or, in other words, the generic character of these reactions? Glycerin or pyrogallol has 3 hydroxyls, erythrite 4, and glucose 6 hydroxyls; yet they all behave in the same generic manner.

As alcohol + ammonia – 2HO = the amide C_4H_5,H_2N,
So arbutin „ „ „ $C_{24}H_{15}O_{12}.H_2N$
Or glucose „ „ „ $C_{12}H_{11}O_{10},H_2N$',

and similarly with glycol, erythrite, pyrogallol, &c.

These radicals are absolute facts, admitting of the clearest evidence, even though they may or may not have a separate free existence; while the hydroxyl hypothesis

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 112.)

If aqueous ammonia is heated in a closed boiler the expulsion of the gas can be carried on even under a strong pressure. If the gas liberated is conducted into a cooler at a certain temperature it passes the point o saturation and condenses to form liquid ammonia. This liquid anhydrous ammonia if brought in connection with a receiver containing water rushes into it with violence and is absorbed. In proportion as the solution is heated, the temperature of the evaporating liquid is lowered, and may fall to –50°. On these principles depends the ingenious apparatus constructed by Ferd. Carré. It has two modifications, adapted respectively for the intermittent and for the continuous production of ice, the former on a small scale for quantities of 1 and 2 kilos., the latter for manufacturing purposes, and arranged so as to turn out 25 to

* "Berichte uber die Entwickelung der Chemischen Industrie Während des Letzten Jahrzehends."

200 kilos. hourly. The apparatus is manufactured by Mignon and Rouart, of Paris. The intermittent machine consists simply of two vessels free from air and connected firmly by means of a tube. The weight of the whole is such that it can be conveniently lifted and turned. One of the receivers contains ordinary liquid ammonia, whilst the other is empty. The operation begins by placing the receiver containing ammonia over a charcoal fire, whilst the empty one is set in a tub of cold water. The gas is expelled by the heat and condensed in the cold receiver, forming a liquid. When all the ammonia has passed over the apparatus is taken up, the receiver which had previously been heated is placed in the tub of cold water, and the substance to be frozen is put in a tin cylinder, fitting into a concavity of the receiver containing the liquefied gas. The latter evaporates, producing a great reduction of temperature, and is again absorbed by the water which has remained in the other receiver.

The continuous apparatus is more complicated. It consists principally of a vertical cylindrical boiler supported by masonry in which the heating and volatilisation of the ammonia for the preparation of liquefied ammonia goes on without interruption. The cylinder consists of two compartments, the lower containing a very dilute solution chiefly deprived of its ammonia, whilst in the upper are a number of bowls, into the uppermost of which flows fresh liquor ammoniæ; the liquid as it overflows enters the next bowl, and so onward. The lower compartment only is exposed to the fire. The very aqueous vapours given off convey as they ascend more and more ammonia into the bowls, which at last evaporates almost, though not absolutely, free from water. The gas now arrives in the cooling apparatus, in which it is condensed to a liquid. The pressure at which this takes place depends on the temperature of the condenser, and varies from 4·4 to 8·5 atmospheres, when the temperature of the water used for cooling ranges from 0° to 20°. The temperature of distillation is about 130°. From here the liquefied ammonia, at the pressure of the boiler, arrives in a regular current in the evaporator (ice-generator), the influx being checked by a regulator. The arrangement of the ice-generator presents nothing worth of remark. A solution of chloride of calcium takes up the cold and transfers it to the water to be frozen. If a liquid, *e.g.*, beer-wort, requires merely to be cooled, no intermediate body is requisite. The ammonia evaporating in the cooler has to be absorbed by water. As an absorbent is employed, the liquid in the lower half of the cylinder, which is not quite exhausted and which issues continuously in a thin stream, arrives cooled in the absorption vessel. The latter, again, must now lie in a cooler in order that the high temperature produced by absorption may not hinder the further reception of gas. Thus, therefore, liquor ammoniæ is formed as at first, and is thrown back into the cylinder by means of a pump, exchanging on the way its heat for that of the liquid drawn off from the lower compartment of the cylinder. As the ammonia evaporating in the cylinder is not quite anhydrous, a certain amount of water reaches the ice-generator, where it gradually accumulates and retards evaporation. From time to time, therefore, the contents of the cooler must be drawn off, and pumped direct into the cylinder.

(To be continued.)

ON CERTAIN CIRCUMSTANCES WHICH AFFECT THE PURITY OF WATER SUPPLIED FOR DOMESTIC PURPOSES.

By M. M. PATTISON MUIR, F.R.S.E.,
Assistant Lecturer on Chemistry, Owens College.

(Continued from p. 104.)

For the following details regarding the amounts of lead found in various samples of aërated beverages in the manufacture of which leaden apparatus had been employed, I am indebted to my friend Dr. Milne, of Glasgow.

Table B.

Lead Found in Various Samples of Aërated Beverages.

Description of Liquid.	Quantity of Lead in grs. per gallon.
Lemonade	0·20
Do.	0·40
Do.	0·05
Gingerade	0·10
Soda-water	0·60
Do.	0·05

In addition to these numbers I have determined the following, which show the amounts of lead dissolved by distilled water charged with carbon dioxide at the ordinary atmospheric pressure for varying lengths of time, and also

Table C.

Lead Dissolved by Water Charged with Carbon Dioxide at Ordinary Pressure.

	Mgms. per litre.	Grains per gall.	Lead Dissolved. In Mgms. per Litre. After 24 hrs.	48 hrs.	72 hrs.	In Grains per Gallon. 24 hrs.	48 hrs.	72 hrs.
Distilled water charged with carbon dioxide	—	—	3	3	3	0·21	0·21	0·21
The water poured off, more added, and again poured off, and finally fresh water containing carbon dioxide added	—	—	none	none	none	none	none	none
Potassium carbonate and ammonium nitrate	100 and 20	7·0 and 1·4	merest trace			merest trace		

Table D.

Lead Dissolved by Water Charged with Carbon Dioxide at a Pressure of about 6 Atmospheres.

Salt.	Mgms. per litre.	Grains per gall.	Lead Dissolved. In Mgms. per Litre. 24 hours.	48 hours.	In Grains per Gallon. 24 hours.	48 hours.
Potassium carbonate	80	5·60	13·2	32·0	0·924	2·24
,,	160	11·20	—	60	—	0·42
Calcium chloride	160	11·20	32·0	44·0	2·240	3·08
Ammonium nitrate	16	1·12	5·0	—	0·350	—
,,	40	2·80	10·0	35·0	0·700	2·45
Distilled Water	—	—	14·8	24·0	1·036	1·68

the amounts dissolved by the same water on the addition of various salts. The surface of lead exposed measured 2100 sq. m.m.

As the results indicated that water charged with carbon dioxide at the ordinary atmospheric pressure exercises no considerable solvent action upon lead, and moreover that this action ceases on the addition of carbonates; the large amounts of lead found in some of the samples of soda-water examined by Dr. Milne are probably due to the increased solvent action of water containing large quantities of carbon dioxide forced into it under pressure. In order to test the truth of this supposition I have made a few determinations of the amounts of lead dissolved by distilled water, and by the same water containing known quantities of various salts when charged with carbon dioxide at a pressure of several atmospheres.

The apparatus consisted of an ordinary *gasogene* used for making so-called "soda-water." From the known capacity of the globe and the weight of sodium carbonate and tartaric acid employed the pressure exerted in the interior of the vessel by the carbon dioxide was calculated as approximately equal to 6 atmospheres.

The surface of lead exposed measured 750 sq. m.m. (See Table D).

It appears from these numbers that distilled water charged with carbon dioxide under a pressure of (approximately) 6 atmospheres dissolves five times as much lead as the same water charged with the gas at the ordinary atmospheric pressure; that the presence of a small quantity of ammonium nitrate does not increase the solvent action until after a lapse of 48 hours or so; and that potassium carbonate, when present in somewhat large quantities, exerts a marked deterrent action. The amount of lead dissolved, however, even in the presence of potassium carbonate, is far too large to allow of such a water being drunk with safety.

(To be continued.)

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, March 16th, 1876.

Professor Abel, F.R.S., President, in the Chair.

Before the ordinary business of the Society commenced, Dr. Gladstone rose and said it was a pleasant duty he had to perform. The Fellows had met last Tuesday at the Royal Arsenal at the invitation of their President, where they had not only had a rare treat of a most intellectual character in visiting the works of the various departments, and in seeing experiments illustrating his discovery in explosives, but had also experienced his generous hospitality. He felt sure the Fellows would agree with him that it was fitting they should express to him their heartiest thanks for his entertainment.

Dr. Gilbert, in a few words, seconded the motion, which was carried by acclamation.

Prof. McLeod remarked that the very interesting experiments on detonation which Prof. Abel had exhibited to them at Woolwich should be regarded as demonstrations, and that he should be asked to furnish a short account of them, which might be entered in the minutes of the Society, and thus form a permanent record of the visit to the Royal Arsenal, which the speaker thought ought to be regarded as a special meeting of the Society.

The President, in replying, said the pleasure he had felt at the manner in which his invitation had been responded to was enhanced by their expression of satisfaction at the arrangements which had been made to enable them to see that vast national establishment, and for which he was deeply indebted to the cordial assistance he had received from his colleagues, the heads of the various departments there.

The minutes of the previous meeting were then read and confirmed, and the presents recently made to the Society announced. Messrs. C. O'Sullivan, W. E. R. Martin, R. Messel, and E. W. Napper were proposed as Fellows, and Messrs. Jonathan Sparke Walton, Jeremiah Head, John Henry Starling, Percy James Winser, Philip Holland, and Alfred Anthony Nesbit were ballotted for and duly elected after their names had been read for the third time.

Dr. P. F. van Hamel Roos then gave a short notice "*On Crystallised Glycerin*," of which he exhibited a large specimen, 56 lbs. in weight. He had found that perfectly pure and dry glycerin will crystallise spontaneously when cooled to 24° F. if the liquid is vigorously agitated, or a ready-formed crystal of glycerin added to it. Moreover, a crystal of glycerin introduced into well cooled ordinary good commercial glycerin rapidly increases in size, most of the impurities remaining in the mother-liquors. He had repeated Redtenbacher's experiments on the fermentation of glycerin, which was said to produce propionic acid; but with pure glycerin he could get no signs of fermentation, and concluded, therefore, that the propionic acid must be derived from some impurity. The solidification of pure glycerin was shown during the reading of the paper.

Dr. Armstrong said with regard to the question of the fermentation of glycerin giving rise to propionic acid, that some time ago, wishing to prepare a quantity of that acid, he had induced his friend Mr. Brown, of Burton-on-Trent, to examine the subject, and he had found that at 20° to 25° C. the addition of yeast to commerial glycerin at first set up a brisk fermentation, and the liquid became turbid from production of bacteria: this action soon ceased, however, and the fermentation could not be again started. It was the experimenter's opinion that the fermentation which took place in this instance was merely due to the presence of some impurity in the glycerin.

The President having thanked Dr. Roos in the name of the Society,

Mr. W. H. Hatcher read a paper entitled "*Notes on the Fatty Acids, and on a Suggested Application of Photography.*" The author, in experimenting on the setting-points of mixtures of the fatty acids with one another and with various other fatty substances, had found that these generally differed to a considerable extent from those obtained by calculation. It would be observed, on reference to the diagrams, that in some cases the curve of setting-points was always above that obtained by calculation—in some always below, and in others, again, partly above and partly below. For instance, in mixtures of palmitic and stearic acids, the curve representing the actual setting-points was abnormally low, whilst with mixtures of palmitic and oleic acids it was abnormally high compared with the line of calculations. Similarly mixtures of the fatty acids with the harder paraffins have their setting-points below their lines of calculations, whilst with the softer paraffins they are mostly above. A series of one hundred small cast blocks of mixtures of palmitic and stearic acid, in proportions varying each from the next by 1 per cent, were exhibited, from an inspection of which it could readily be observed that the mixtures formed three groups of highly crystalline composition, separated by two groups of close fine-grained material. A series of one hundred and forty beautiful photographs of the crystalline structure of these mixtures, and some others as seen by polarised light, was also shown.

In reply to a question of the President, the author said the setting-points were determined by stirring a portion of the melted material in a test-tube with a thermometer, and noting the fall of the mercury until this became stationary. The points of solidification, as far as his experience went, were the same in all vessels. They had been compelled to reject all methods of determining melting-points as giving fallacious results.

Mr. Field said he had listened with great interest to Mr. Hatcher's excellent paper, and had himself always used the method just described for ascertaining the solidifying-points of fats. There were some curious points about the solidification of mixtures, which it was at present somewhat difficult to understand. For instance, a mixture of stearic acid of solidifying-point of 130° F., and spermaceti of 112° F., gave a mixture below either, namely, 108° F. Similarly, a mixture of stearic acid of 130° F., and paraffin of 130° F., gave one of 112° F.; and, still more curious, a mixture of high melting-point stearic acid from cotton seed with animal stearic acid of 130° fused at a point below that of the animal stearic acid.

In reply to a question of Dr. Müller as to the method of purification employed, the author replied that fractional crystallisation from alcohol and from ether had been used. By these means it was easy to obtain the palmitic acid in a pure state; for although a mixture of 90 parts of palmitic acid with 10 of stearic crystallised from alcohol unchanged, the two could be readily separated by crystallisation from ether, or, still better, from benzene, in which stearic acid is more soluble than palmitic. The palmitic acid had almost the same melting-point as that given by Heintz (60·8° C.), and the stearic acid from cocoa butter melted at 68·6° C.

Dr. Thudichum objected to the use of alcohol in the purification of the fatty acids, as he had found that fatty ethers were formed in such cases with great rapidity, especially when absolute alcohol was employed. Even in the cold, if the mixture was allowed to stand, ethers were gradually formed.

The President having thanked Mr. Hatcher for his valuable paper, which had given rise to such an interesting discussion,

Mr. F. Jones proceeded to read a communication "*On Stibine.*" The author had examined the gases obtained by the action of acids on an alloy of zinc and antimony, by the addition of an antimony solution to a mixture of zinc with a dilute acid, and by the action of sodium amalgam on a concentrated solution of antimony chloride. In all cases, however, the stibine was mixed with a very large amount of free hydrogen, so that the attempts to analyse it eudiometrically by observing the increase of volume it underwent when submitted to the action of the electric spark, led to unsatisfactory results. The author also examined the so-called silver antimonide, produced by passing the mixed gases through a solution of silver nitrate, and ascertained that the precipitate invariably contains a considerable quantity of uncombined silver in fine filaments. The action of stibine on sulphur is very marked, the gas being decomposed, with formation of antimony sulphide and sulphuretted hydrogen according to the equation, $2SbH_3+6S=Sb_2S_3+3H_2S$. This reaction takes place slowly at 100° C., rapidly in sunlight, and accompanied as it is by the production of the red antimony sulphide, affords an extremely delicate qualitative test for antimony, the author having in one case obtained a distinct colouration with 0·00007 grm. of antimony. He has also utilised this reaction for obtaining photographic copies of fern fronds, &c., by placing them on paper coated with sulphur in an atmosphere containing stibine, and exposing them to light: the unprotected parts rapidly assume a deep orange colour, whilst the protected portions remain yellow. It was attempted to make this property the basis of a photometric process, and with fair success, the chief objection being the difficulty of obtaining and preserving the stibine of uniform strength.

Mr. Spiller said he had listened to the paper with great interest, especially as it seemed to afford a new method for photometric observations. He must also be allowed to congratulate Mr. Jones on his photographic results.

The Secretary then gave an abstract of Mr. F. Köpfer's paper "*On the Use of Platinum in the Ultimate Analysis of Carbon Compounds.*" The author burns the substance in a platinum boat in a current of oxygen, the anterior portion of the tube containing spongy platinum and coils of fine platiuum wire. The results he has obtained with sugar and with aurin are very satisfactory. For the analysis of liquids the apparatus is specially arranged, and the author purposes to extend the method to carbon compounds containing chlorine, nitrogen, sulphur, and other elements.

Mr. W. H. Perkin said he had some time ago made experiments on the combustion of carbon compounds in oxygen by means of platinum, with the object of simultaneously determining, not only the carbon and hydrogen, but also the chlorine. He then described the method, but had abandoned it on account of the practical difficulties, not only in obtaining glass which would resist the action of chlorine, and especially bromine, but also from the liability to explosions.

The last paper was by Mr. G. Beckett and Dr. C. R. A. Wright, "*On the Action of Organic Acids and their Anhydrides on the Natural Alkaloids* (Part V.). As far as regards the formation of acetylated derivatives, whilst codeine and morphine easily yield them, only negative results have been obtained by the action of acetic anhydride on narcotine (and its derivatives, hydrocotarnine and cotarnine), narceine, papaverine, and thebaine. Strychnine forms an amorphous diacetyl-strychnine, and amorphous acetyl derivatives were obtained on treating quinine and quinidine with acetic anhydride, which on saponification gave a base, apparently quinicine. A non-crystalline monacetyl-cinchonicine was also formed on submitting cinchonine and cinchonidine to similar treatment.

The President, after thanking the authors, adjourned the meeting until Thursday, March 30, the Anniversary.

NOTICES OF BOOKS.

A Dictionary of Hygiene and Public Health. By A. Wynter Blyth, M.R.C.S., &c. London: C. Griffin and Co.

We have here a kind of encyclopædia of sanitary science in the widest sense of the term, including the detection of adulterations, the dietetic value of foods, sanitary chemistry, toxicology, and laws relating to public health. In a book of this extent, compiled from very various sources, the matter cannot, of course, be uniform in value. Still, upon the whole, we consider the work as likely to be useful.

From the notice of absinthe we learn, with regret, that the quantity of this fearful poison consumed in London has been enormously on the increase. How is it that none of our professed philanthropists can take up this question? Its importation, manufacture, and sale should be totally prohibited. Arsenic has its legitimate uses; absinthe has none.

On the propagation of cholera we find a passage, the more important as it must evidently apply in a like manner to plague, typhoid, yellow fever, &c.:—"The discharges being liquid, the great bulk of them find their way to the ground, from which the poison may be propagated in three ways: (*a*), by rising into the air as a product of evaporation; (*b*), by percolating into the drinking-water; (*c*), by atmospheric dispersion in the form of impalpable dust after it has passed into the dried state." If such is the case, what more perfect arrangement could be devised for the dissemination of epidemics than a sewage irrigation farm where the first and third of these methods of propagation must be alternately at work?

In the article on the disposal of the dead the author justly condemns the proposed wicker-work coffins, from the facility they would afford for the escape of noxious emanations. The Turks do not use coffins, and the horrible smell arising from their cemeteries is well known.

The author recommends for graves a minimum depth of 8 feet, and in the selection of land for cemeteries would make it a condition that neither rock nor water should come within 10 or 12 feet of the surface. If the soil is damp it should be deeply drained. We ask—Into what? Cemeteries are unfortunately often placed on eminences in the outskirts of cities, into which their drainage can and does descend. We could give instances of this in the suburbs of London, but to tell the truth is often libellous. Dr. Blyth also proposes that not more than one body should be placed in each grave, and that the length and breadth of each burial allotment should be 8 feet by 4. These recommendations, from a sanitary point of view, are very judicious, but they would necessitate the devotion of a very large area of land to the purpose of burial. This evil would be partially met by his proposal that after eighty years from the last burial the land should revert to secular—we hope he means agricultural—uses.

In speaking of smoke, the author declares that black smoke contains a much larger proportion of carbonic acid than ordinary smoke. Now, as carbonic acid is the product of the perfect combustion of carbon, we should expect that the blacker the smoke—*i.e.*, the less perfect the combustion—the smaller would be the proportion of carbonic acid.

Sometimes the author seems to contradict himself. Thus, in the article on "plague," it appears to be considered as identical with the "black death" of the Middle Ages. But when we turn to "black death" it is there stated—"We are of Englada's opinion, that it was a distinct species, and that now it no longer exists."

On the subject of sewage treatment Mr. Blyth might, we think, have easily procured more complete and accurate information. Hille's (not Hill's) process, as carried on at Wimbledon and elsewhere, consists in the precipitation of sewage by lime, chloride of magnesium, and tar. The effluent from Whitthread's (not Whitbread's) process, being admitted to contain phosphoric acid and ammonia, can scarcely be termed inoffensive. Phosphate of ammonia has a very marked action in setting up putrefaction when brought in contact with organic matter, and its removal from sewage is hence of the highest importance. The account of the A B C process is at once imperfect and incorrect; the materials now used are basic sulphate of alumina, carbon, and clay, and the effluent water has been found to come within the standard of the Rivers Pollution Commissioners. Much of the evidence advanced in favour of irrigation can scarcely be pronounced worth the paper upon which it is printed.

On the subject of disinfection the author very judiciously remarks that there "never will be any one disinfectant which will be useful, like a quack pill, for every kind of contagion.

Under the head "Microscope" Mr. Blyth recommends the "Hartnack" as indisputably the best for the Medical Officer of Health and the Public Analyst.

In speaking of hospitals the author declares—"If the political, moral, and religious state of the ancients be examined, it is easy to be convinced that they had not, nor could they have, hospitals; for to found and maintain them a virtue was necessary which paganism was destitute of, namely, Charity; and it is to this virtue, wholly Christian, that we owe these buildings, which—begun in the first days of Christianity—have continued to our time." Now if Mr. Blyth will refer to Tennant's "Ceylon" he will find that in that island hospitals for men and for animals existed as early as 400 B.C.

To Medical Officers of Health it will doubtless prove very convenient to be thus furnished with what may be called an encyclopœdia of professional knowledge and official obligations, and in spite of the shortcomings which we have indicated, and of others which want of space has compelled us to pass over, we think that the author has supplied a desideratum in our sanitary literature. The work is enriched with 140 illustrations, and with a map of the geographical distribution of disease.

CORRESPONDENCE.

DETERMINATION OF GLYCERIN AND SUCCINIC ACID IN WINES.

To the Editor of the Chemical News.

SIR,—I find in the CHEMICAL NEWS (vol. xxxi., p. 186) a new method of "Determination of Glycerin and Succinic Acid in Wines," by E. Maumené, taken from the French journal *Les Mondes*. I beg to inform you that this new analytical method was not found by Maumené, but such a process for determining glycerin and succinic acid is mine. Erroneously it was so stated in *Les Mondes* (No. 9, March 4, 1875), but in a subsequent number of the same journal the fault is corrected (See *Les Mondes*, No. 2, May 13, 1875, pp. 73 and 74).—I am, &c.,

I. MACAGNO.

Asti (Italy), March 18, 1875.

WATER ANALYSIS.

To the Editor of the Chemical News.

SIR,—The recent discussion upon this subject before the Chemical Society, though voluminous, is in some respects unsatisfactory. One especial feature in connection with it is the want of independent and impartial testimony in favour of the combustion process of Frankland and Armstrong. Of all the speakers four only (as reported in the CHEMICAL NEWS) can be said to have spoken in favour of this process, and of these four one (Dr. Armstrong) was one of the original discoverers of the method, and another (Mr. Thorp) is or was the chief chemist in the laboratory of the Rivers Commission, where Dr. Frankland and his method reign supreme. This want of testimony is no doubt to be accounted for by the fact that the process has not yet won its way to the appreciation of chemists; but this circumstance is in itself a powerful argument against the process. It has had the same chance as its rival, it is older than the ammonia process, and it possesses a powerful and eloquent advocate in its discoverer. What, then, is the cause of its non-success? The object of a water analysis usually is to answer the question—"Is this water fit for drinking?" And it is because the Wanklyn process enables us to answer this question far more readily than the Frankland process that it is more frequently employed. Until Dr. Frankland has proved not only that this method does not give a constant fraction of the nitrogen as ammonia, but also that it affords no indication of the purity of a water, he may rest assured that his more elaborate, if more exact, process will only be resorted to in rare cases where great accuracy is required.

And here, Sir, I have not questioned in any way the accuracy of the Frankland process. The experiments published by Dr. Frankland seem to show that under certain circumstances (in the absence of nitrates) it gives very accurate results; but it has still to be shown that in the hands of other chemists, and under different conditions, the same results can be obtained. The sulphuric acid formed by the oxidation of the sulphurous would certainly be imagined to affect the destruction of some of the organic matter present, but Dr. Armstrong and Dr. Frankland say that it does not,—so that this question is taken out of the region of theory into that of fact.

The existence of nitrates in a water is taken by Dr. Frankland as a proof of the previous contamination of that water by sewage matter, and their amount is considered proportional to the amount of such contamination. This position seems untenable, for nitrates are found in some of the most wholesome of waters, and they vary in quantity perhaps more than any other constituent. Also when we consider that their presence in a water may arise in two ways,—first, by the solution of previously-formed

nitrates, and second, by their formation in the water itself, —I fail to see how the amount can be a measure of the sewage from which they are formed in the second only of the above cases. But even allowing that they measure accurately the amount of previous sewage contamination, of what value is this knowledge? The sewage has now become oxidised and the organic nitrogen converted into inorganic, or that which was injurious previously is injurious no longer. Thus if the presence of nitrates is a proof of anything, it is that the water has become purified to a certain extent at least.—I am, &c.,

ERNEST H. COOK.

Bristol, March 17, 1876.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences. No. 9, February 28, 1876.

Explosion of Gunpowder.—M. Berthelot.—The explosion of gunpowder yields at first all possible bodies, that is to say, all bodies which are stable under the conditions of the experiment; these are principally potassic sulphide, sulphate, and carbonate, carbonic acid, carbonic oxide, nitrogen, and watery vapour. These bodies originate in proportions, which vary with the local circumstances of mixture and of ignition. If they remain in contact for a sufficient time they undergo reciprocal actions capable of bringing them to a state corresponding with the maximum heat evolved, that is to say, the state of sulphate of potash and of carbonic acid.

Researches on a Sulphate which appears to contain a New Oxide of Manganese.—M. E. Fremy.—All chemists know the vinous-red liquid formed in the preparation of oxygen by the action of concentrated sulphuric acid upon the peroxide of manganese. This body is very unstable, being decomposed by heat and by water, and is produced in very small quantity, and only from certain samples of manganese. The author has succeeded in preparing it in larger quantity, and considers that it contains the sulphate of a new oxide, but reserves the details for a future communication.

Influence of Vegetable Mould upon the Nitrification of Azotised Substances of Organic Origin used as Manure.—M. Boussingault.—The author maintains that nitrification is due to vegetable mould, since in sand and chalk blood furnishes merely traces of nitrates.

Oil of Elæococca, and on its Solid Modification as Produced by the Action of Light.—M. Cloëz.—In the liquid oil the author finds elæolic and margarolic acids, apparently derived from two neutral proximate principles, elæolin and margarolin, the mixture of which forms the largest part, if not the whole, of the Elæococca. The solidified oil contains, on the contrary, stearolic acid, fusible at 72°, and containing—

Carbon	74·30
Hydrogen	11·16
Oxygen	14·54
	100·00

Certain Compounds of Titanium.—MM. C. Friedel and J. Guerin.—The authors describe the oxychloride, $Ti_2O_2Cl_2$; the sesquioxide, Ti_2O_3, and the tetrachloride.

On Sulpho-phenylurea.—M. Ph. de Clermont.—The author obtains this compound by causing the hydrochlorate of phenylamin to react upon the sulphocyanide of ammonium in equivalent proportions at the heat of the water-bath. Double decomposition takes place according to the following equation:—

$$C_6H_7N,HCl + CN,NH_4S = CS,NH_2,C_6H_5 + NH_4Cl.$$

Antiseptic Properties of Borax.—M. Schnetzler.—The author refers to the vast deposits of borax discovered by Mr. Robottom in Southern California, and recommends it as preferable to salicylic acid for the preservation of articles of food.

Reducing-Sugar Contained in Crude Sugars.—M. A. Müntz.—A brief controversial note.

Manufacture of Superphosphates.—M. A. Millot.—The author declares that superphosphates never go back if neither iron nor alumina is present, and if a sufficiency of acid is used. With phosphatic minerals containing superphosphates this is no longer the case. With the coprolites of the green-sand, and a quantity of acid sufficient to attack the carbonate and phosphate, the reversion is very considerable, and is complete in about two years. If the sulphuric acid is deficient the reverted phosphate is a mixture of phosphate of iron and of bicalcic phosphate. The acid phosphate of lime is decomposed during desiccation, and splits up into bicalcic phosphate and phosphoric acid, which combines with the oxide of iron. Alumina is never attacked by phosphoric acid in these products.

Moniteur Scientifique, du Dr. Quesneville, March, 1876.

Industrial Preparation of Sulphuric Acid and Chloride of Lime in the South of France.—M. A. Favre.—The sulphuric acid is entirely obtained from pyrites, roasted in furnaces capable of revolving on their axle. The depth of the kiln is 1·80 m., and its surface 1·20 m. The pyrites are burnt down to 2 or 3 per cent. In many works the pyrites are burnt in too shallow layers, when the combustion becomes too brisk, and is necessarily incomplete. The kilns are not always well proportioned in number and power to the size of the lead chambers. The author approves of the following proportions:—180 cubic metres of chamber room to 1 square metre of surface of kiln grating, upon which are burnt every twenty-four hours 270 kilos. of pyrites at 40 per cent of sulphur, corresponding to 150 kilos. pyrites to 100 cubic metres of chamber room. He adds that the capacity of the chambers may be better utilised by cooling the gases before their entrance into the chambers. The chambers are generally erected in sets of three—a large one and two smaller ones following. The size most approved for the large chambers is 45 metres in length by 8 in width and 6 in height. The total cubic bulk of a set of three chambers is 4000 cubic metres. The sides are generally exposed to the weather, which makes it impossible to maintain a uniform temperature, and in summer the heat rises to 65°. The cost of 1000 kilos. of acid at 50° (Baumé?) is stated at 36·9 francs. In the manufacture of chloride of lime great care must be taken in burning the lime to be employed. If the heat is too great the lime is not easily slaked, and there results a dense mass, ill adapted to absorb the chlorine. If there are unburnt portions the evils are the same. If the lime is properly and uniformly burnt it is light and porous, and if the chlorine is evolved slowly, so as to prevent a great rise of temperature, a chloride of lime is obtained which marks 110° and which is permanent. The casks, he thinks, should not hold more than 250 kilos. each. The cost of 1000 kilos. chloride of lime at 110° he gives at 244·50 francs.

Reimann's Farber Zeitung, No. 8, 1876.

According to Schwamborn, lyes from washing indigo-blue cloths are not easily precipitated with milk of lime. The precipitation is rendered easy if the glue present in solution is previously removed by the addition of a decoction of sumach. As is well known, alumina and iron are

not precipitated by alkalies if fixed organic matter is present in solution. Are the cases analogous?

According to G. Witz, of Rouen, each of the eighty printing-machines in France consumes daily 36 kilos. of egg albumen, equivalent to 12,000 eggs. In 1860 the print works of Alsace, with 100 machines, consumed 125,000 kilos. = 37,500,000 eggs, the yield of 250,000 hens. An ox yields 400 grms. of dry blood albumen; 1 kilo. of albumen represents 2½ oxen, 10 sheep, or 17 calves.

MISCELLANEOUS.

Refrigeratory Processes.—In our translation of Dr. Hofmann's "Report on the Development of the Chemical Arts" we have laid before our readers an account of several processes for the manufacture of ice. It may therefore be interesting if we briefly notice the Reece's ice-machine, in which the combustion of 1 ton of coal is made to yield 20 tons of ice, at a total expense not amounting to five shillings per ton. Like Carré's machine, which we have already described, the apparatus in question is worked with ammonia. But there is a very important difference between the two processes. The Carré machine distils over weak ammoniacal gas, whereas the Reece machine makes it anhydrous. The gas produced by the former contains 25 per cent of water, which permanently dissolves and renders useless an equal weight of ammonia. One-third of the whole ammonia distilled is thus rendered useless—the fuel to distil it, the cold to refrigerate it, and the power to move it all being wasted. The consequences are, that ten times as much liquor is required to be kept in movement and pumped over and over again into the boiler against a very high pressure, four times as much water is required to cool the distilled vapour, and ten times as much power is required to drive the machines. They have, consequently, to be made much larger or more numerous, and are thus dearer in first cost, as well as infinitely more expensive to work than Reece's. This system, therefore, seems to surpass that of Carré as decidedly as that in turn excels the ether machine, and for the present, at all events, Reece's process must be considered the most practical and efficient known. The machine can be managed by an unskilled workman, and the escape of ammonia is imperceptible—an important point, both as regards economy and comfort. The importance of having at command a means of producing ice in quantity, or of reducing at will the temperature of liquids and solids is indisputable. In our chilly summers, indeed, ice can never play the part which it does in sunnier regions, but in the importation and preservation of fresh meat, milk, and various other articles of food, it has before it a wide future. In various chemical manufactures, also, a ready and economical means of lowering the temperature of liquids has long been desired. Several of the machines are now in operation in London, and the quality of the ice we have seen seemed to be equal to the finest specimens of foreign ice.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

Improvements in the means for producing gas from an admixture of atmospheric air with paraffin, petroleum, naphtha, oil, or spirit containing a large amount of carbon, the said gas being adapted for lighting or heating purposes. J. Mather, Gateshead-on-Tyne, Durham. January 20, 1875.—No. 211. Atmospheric air rushing through a jet produces a vacuum in a small chamber or generator, into which also opens a jet from a vertical tube descending into a cistern containing the carboniferous fluid. This vacuum causes the fluid to ascend the tube and to issue from the jet in a spray, which combines with the air rushing by. This combination is carried forward along a tube that passes through a furnace or oven, and finally conveyed in a gaseous state to the hydraulic main, and thence to store tanks.

Improvements in the disinfection of solid and liquid matters, such as night-soil sewerage, either together or separately, gas, and other foul waters. J. Box, Great George Street, Westminster, E. Aubertin, L. Boblique, and H. Leplay, all three of Paris. January 20, 1875.—No. 214. We employ a soluble alkaline phosphate and a soluble salt of magnesia and oxide or other form of iron. We employ these agents in different combinations. We prefer phosphate of potash or ferruginous soda prepared by calcination in a reverberatory furnace, the phosphate of iron with the sulphate of soda and a soluble salt of magnesia, such as the chloride of magnesium. The liquid to be disinfected is allowed to run through the raw products as they leave the reverberatory furnace; the sulphuretted hydrogen is deposited in the state of sulphate or iron. To the liquid thus deprived of the sulphuretted hydrogen soluble salt of magnesia is added; magnesium phosphate of ammonia is formed, and precipitates itself with the aforesaid organic matters. To disinfect solid matters the same products are used dry in powder. We also employ phosphate of lime dissolved in hydrochloric acid, and oxide of iron also dissolved in chlorhydric acid.

Improvements applicable in the treatment and manufacture of metals and their alloys. W. H. Smith, Edgbaston, Birmingham, Warwick. January 20, 1875.—No. 227. This invention consists mainly in the improvement and purifying of iron, steel, copper, lead, zinc, nickel, and their alloys, and treating and manufacturing the same in prescribed manner in converters, cupolas, receivers of metal, or any other suitable vessel or vessels; and consists of introducing into or upon iron, steel, copper, lead, zinc, nickel, and their alloys, when in the above-named vessels and in a molten or liquid state, alumina, lime, soda, potass, and baryta, either mixed or separate, with oxides of iron, manganese, titanium, vanadium, tungsten, and chromium, either manufactured or in the natural metallic form; and I use them either singly or together, and in such proportion or proportions as may be required, with or without solid or gaseous carbons. It also consists in an improved arrangement of tuyeres as applied to such converters or vessels.

Improvements in the manufacture of steel. A. M. Clark, Chancery Lane, Middlesex. (A communication from J. Eyquem, Paris.) January 22, 1875.—No. 256. The invention consists in the use for cementing iron on a large scale of ammoniacal and carburetted hydrogen gases acting simultaneously, and produced by the decomposition of a mixture of sal ammoniac and a substance such as peat, tan, and other substances, or liquids furnishing proto or bicarburetted hydrogen. It also consists in the manufacture by the above means of cast-steel from scrap-iron, ores, refining-slag, and other products.

NOTES AND QUERIES.

Calcium Phosphates.—On page 365, under the heading "Calcium Phosphates," of Fownes's "Manual of Chemistry," it is mentioned that there are two tri-basic phosphates, $Ca_3P_2O_8$ and $CaHPO_4$, and that when the first phosphate is digested with ammonia, that it is converted into the second. Is it therefore meant that by the addition of ammonia to an acid solution of $Ca_3P_2O_8$, that $CaHPO_4$ is precipitated, and not $Ca_3P_2O_8$? I have always understood that tri-calcic phosphate was precipitated, and that it could be filtered off, dried, ignited, and weighed as such.—AMATEUR.

MEETINGS FOR THE WEEK.

SATURDAY, 26th.—Physical, 3. "On Salt Solutions and Attached Water," by Prof. F. Guthrie, F.R.S. "On some Problems connected with the Flow of Electricity in a Plane," by O. J. Lodge.
MONDAY, 27th.—Medical, 8.
—— London Institution, 5.
—— Royal Geographical, 8.30.
—— Society of Arts, 8. Cantor Lectures. "Wool Dyeing," by George Jarmain.
TUESDAY, 28th.—Civil Engineers, 8.
—— Anthropological Institute, 8.
—— Royal Institution, 3. "On the Classification of the Vertebrated Animals," by Prof. Garrod.
—— Society of Arts, 8. (African Section). "The Industries of South Africa," by T. B. Glanville.
WEDNESDAY, 29th.—Society of Arts, 8. "Model Dwellings for the Rich," by T. Roger Smith and W. H. White.
THURSDAY, 30th.—Royal, 8.30.
—— Royal Institution, 3. "Polarised Light," by Mr. Spottiswoode.
—— Chemical, 8. (Anniversary.)
—— Philosophical Club, 6.
—— London Institution, 7.
FRIDAY, 31st.—Royal Institution, 9. "Physiological Action of Light," by Prof. Dewar.
—— Society of Arts, 8. (Chemical Section). "The Methods of Estimating the Illuminating Power and Purity of Coal Gas," by A. Vernon Harcourt, M.A., F.R.S.
SATURDAY, April 1st.—Royal Institution, 3. "Wagner," by Mr. Dannreuther.

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EXERCISES in ELECTRICAL and MAGNETIC MEASUREMENT, with Answers. By R. E. DAY, M.A., Author of "Numerical Examples in Heat."

London: LONGMANS and CO.

THE CHEMICAL NEWS.

VOL. XXXII. No. 853.

ON REPULSION RESULTING FROM RADIATION.*

By WILLIAM CROOKES, F.R.S., &c.

PART IV.

In this paper the author describes experiments on the repulsion produced by the different rays of the solar spectrum. The apparatus employed is the horizontal beam, suspended by a glass fibre and having square pieces of pith at each end coated with lampblack. The whole is fitted up and hermetically sealed in glass, and connected with an improved mercury pump. In front of the square of pith at one end a quartz window is cemented on to the apparatus, and the movements of the beam, when radiation falls on the pith, are observed by a reflected ray of light on a millimetre scale. The apparatus was fitted up in a room specially devoted to it, and was protected on all sides, except where the rays of light had to pass, with cotton-wool and large bottles of water. A heliostat reflected a beam of sunlight in a constant direction, and it was received on an appropriate arrangement of slit, lenses, prisms, &c., for projecting a pure spectrum. Results were obtained in the months of July, August, and September; and they are given in the paper graphically as a curve, the maximum being in the ultra-red, and the minimum in the ultra-violet. Taking the maximum at 100, the following are the mechanical values of the different colours of the spectrum:—

Ultra-red	100
Extreme red	85
Red	73
Orange	66
Yellow	57
Green	41
Blue	22
Indigo	8½
Violet	6
Ultra-violet	5

A comparison of these figures with those usually given in text-books to represent the distribution of heat in the spectrum, is a sufficient proof that the mechanical action of radiation is as much a function of the luminous rays as it is of the dark heat-rays.

The author discusses the question "Is the effect due to heat or to light?" There is no real difference between heat and light; all we can take account of is difference of wave-length, and a ray of a definite refrangibility cannot be split up into two rays, one being heat and one light. Take, for instance, a ray of definite refrangibility in the red. Falling on a thermometer it shows the action of heat, on a thermo-pile it produces an electric current, to the eye it appears as light and colour, on a photographic plate it causes chemical action, and on the suspended pith it causes motion. But all these actions are inseparable attributes of the ray of that particular wave-length, and are not evidences of separate identities.

The author enters into some theoretical explanations of the action of the different parts of the spectrum, but these cannot well be given in abstract.

An experiment is given by which sunlight was filtered through alum, glass, and water screens, so as to cut off the whole of the ultra-red or dark heat-rays. The ray of light which was thus freed from dark heat was allowed to fall on the pith surface of the torsion apparatus, when it produced a deflection of 105°. When a solution of iodine in disulphide of carbon was now interposed the deflection fell to 2°, showing that the previous action was almost entirely due to *light*. With a candle tried under the same circumstances, the light filtered from dark heat produced a deflection of 37°, which was reduced to 5° by interposing the opaque solution of iodine.

In order to obtain comparative results between disks of pith coated with lampblack and with other substances, a torsion apparatus was constructed, in which two or more disks could be exposed one after the other to a standard light. One disk always being lampblacked pith, the other disks could be changed so as to get comparisons of action. Calling the action of radiation from a candle on the lampblacked disk 100, the following are the proportions obtained:—

On Lampblacked pith	100°
Iodide of palladium	87·3
Precipitated silver	56
Amorphous phosphorus	40
Sulphate of baryta	37
Milk of sulphur	31
Red oxide of iron	28
Scarlet iodide of mercury and copper	22
Lampblacked silver	18
White pith	18
Carbonate of lead	13
Rock-salt	6·5
Glass	6·5

In consequence of some experiments tried by Profs. Tait and Dewar, and published in *Nature*, July 15, 1875, the author fitted up a very sensitive apparatus for the purpose of carefully examining the action of radiation on alum, rock-salt, and glass. The source of radiation was a candle. Perfectly transparent and highly polished plates of the same size were used, and the deflection was made evident by an index ray of light. Taking the action on the alum at 100, that on the rock-salt in five successive experiments was 81, 77·3, 71, 62·5, 60·4. This increasing action on the alum was found to be caused by efflorescence, which took place rapidly in the vacuum, and rendered the crystal partially opaque. A fresh alum plate being taken, this and the rock-salt were coated with lampblack and replaced in the apparatus, the black side away from the source of radiation, so that the radiation would pass through the crystal before reaching the lampblack. The action of radiation was in the proportion of blacked alum 100, to blacked rock-salt 73.

* Abstract of a paper read before the Royal Society, Feb. 10, 1876.

EARLY USE OF CHLORINE FOR BLEACHING PURPOSES.

By G. A. KEYWORTH, F.C.S.

AFTER the discovery of chlorine by Scheele in 1774, its power of destroying vegetable colours seems to have remained without practical application until 1785, when Berthollet drew attention to this property. The merit of first employing chlorine industrially at bleach works belongs to Mr. Robert Hall, who resided at Basford Hall, near Nottingham. He had long been an able and ingenious experimenter, and was a man whose character was singularly beautiful. Well read in the chemical literature of that period, *i.e.*, *the Annales de Chimie*, *Nicholson's Journal*, and the writings of Black, Scheele, Lavoisier, and Berthollet, he corresponded with Henry of Manchester, and with Priestley of Birmingham. The former had, it is said, received from Germany a phial of chlorine water, then called oxygenated muriatic acid, and to have sent it to Mr. Hall, pointing out the bleaching which the cork had undergone. Mr. Hall lost no time in trying the

effect of the new agent in a neighbouring bleach yard belonging to his brother-in-law, Mr. White. Here, in a place still called from the circumstance "Bedlam," the first failures and successes occurred. Much too strong a solution turned the fabric to tatters, but by degrees the new agent became manageable and successful. My father, whose early days were spent with these relatives, often spoke of the experiments, and during his life took occasion to mention them to chemical lecturers and others. The use of lime by Tennant, of Glasgow, as an absorbent of chlorine, in 1798, seems to have overshadowed these interesting early results.

The facts, however, are stated in "Self Help," by Mr. Smiles. The author of a paper on "Bleaching" in the useful Stanford Series of "British Manufacturing Industries," does not allude to them.

Assisted by Mr. Fox, whose family still carry on the bleach works, Mr. Hall made starch there, and chlorine was employed to bleach it by his son, Samuel, afterwards the inventor of the well-known Hall's Condenser for Marine Engines.

Marshall Hall, the distinguished physiologist and physician, was another son of Mr. Robert Hall.

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 125.)

THE first intelligence concerning the apparatus here described is contained in a communication by Carré to the Paris Academy, December, 1860.† The inventor's English patent bears the date October 15, 1860. Not long after, in January, 1861,‡ MM. Tellier, Budin, and Haussmann, sen, claimed priority in the invention, which they had patented in July, 1860.‖ For machines on the small scale they recommended at the same time sulphurous acid instead of ammonia, since, though less soluble in water, it requires only half the pressure. The courts of law appear, however, not to have decided the question of priority in favour of these gentlemen, as their name does not occur in connection with the further development of the machine. We find, however, that Tellier, in the year 1862,§ issued a report in which he recommended ethylamin and methylamin for use on the large scale instead of ammonia. The vapour of the latter is absorbed by water in double the volume of ammonia and possesses a very slight tension, so that the internal pressure in the apparatus scarcely exceeds one atmosphere. Hitherto, however, we do not learn that machines for the application of these substances have come into use. Since Tellier has recently— as we have mentioned above—constructed an air-pump machine for methylic ether, it may be suspected that peculiar difficulties have been found in the utilisation of these amines. A detailed description of Carré's continuous machine with illustrations has been published by Pouillet.¶ An illustrated account of the small intermittent apparatus may be found in the *Würtemberg Gewerbeblatt* for 1861, No. 40, and has been copied into other journals.** In 1868, the author drew up for the *Badener Gewerbezeitung*, a paper on ice machines based upon experiments undertaking with the small machines then known.

In this essay Carré's small apparatus is described and illustrated by diagrams. The larger, or 2 kilos. size, yielded 2½ kilos. ice with a consumption of ¾ kilo. of wood charcoal, the time of heating being 80 minutes, and that of freezing two hours. Ingenious and effective as is this apparatus, it cannot be recommended for household use, as its manipulation requires too much technical skill. In the *Badener Gewerbezeitung* for 1869, followed an account of the machines for manufacturing purposes, in which Carré's large machine is described and figured. It was then and there announced that two German firms, Kropff and Co., of Nordhausen (since 1867), and Vaas and Littmann, of Halle on the Saale (since 1868), have taken up the manufacture of ammonia ice machines on Carré's principle. The former of these firms has now become a joint stock Ice Machine Company. According to the most recent quotations, both these establishments furnish the larger apparatus in five sizes, yielding from 25 to 500 kilos. of ice per hour at the price of 4800 to 30,000 reichsmarks (say from £240 to £1500). The Nordhausen Company manufacture also a small apparatus, for 7½ kilos. per hour, for 2250 marks (£112 10s.). According to their statements 1 kilo. of coal, according to the size of the machine produces from 6 to 16 kilos. of ice.

(To be continued.)

ON A NEW DECOMPOSING FURNACE PATENTED BY MESSRS. JONES AND WALSH.*

By R. C. CLAPHAM, F.C.S.

THE best methods of decomposing salt with sulphuric acid have long attracted the attention of manufacturers, for it is admitted on all sides that those adopted in practice have been unsatisfactory—leading to expenses from the partial stoppage of work by the breakage of pans, and also to a waste of sulphuric acid.

When the present system of making soda was commenced on the Tyne in 1820 the chemical trade was in its infancy, and small lead pans lined with brickwork were used to decompose salt, a charge of 2 cwts. of salt was taken, and sulphuric acid was slowly poured upon it from a carboy through a hole in the roof of the furnace, and it took three hours to complete the operation. But as these lead pans were so liable to be injured, a fire-brick furnace was substituted in 1828, which was then looked upon as an improvement, and was well known locally as "The Dandy Furnace." At that time no attempt was made at the condensation of the hydrochloric acid fumes, and they passed directly into the atmosphere.

A great improvement upon the above was introduced in 1840 by the late Mr. John Lee, who applied a metal pan about the same size as we now use, and its adoption by the trade has led, amongst other advantages, to a large saving of sulphuric acid. This pan has, however, been always liable to frequent breakages from negligence of workmen and other causes, and to get over this difficulty various substitutes have at times been tried. In 1860 I had some fire-clay pans made at the Scotswood Brick Works, which were used at the Walker Alkali Works. They were found to work pretty well, but were difficult to heat, and were at last given up.

If we grant that the life of an ordinary decomposing pan is long enough to turn out 2000 tons of salt (and many of those present know that in many cases 1000 tons is a fair quantity), I calculate that, on the Tyne alone, not less than £5000 per annum is spent in the renewal of decomposing pans; and when we take into account the loss of

* Read at the Newcastle Chemical Society, March 23, 1876.

* "Berichte uber die Entwickelung der Chemischen Industrie Während des Letzten Jahrzehendes."

† Carré, *Comptes Rendus*, li., 2023.

‡ Tellier, Budin, &c., *Comptes Rendus*, l i., 142.

‖ *Dingler, Polyt. Journ.*, clx., 23 and 120.

§ Tellier, *Comptes Rendus*, liv., 1108. *Dingl. Polyt. Journ.*, clxv., 450.

¶ Pouillet, *Bull. Soc. d'Encouragement*, 1867, 32. *Dingl. Polyt. Journ.*, clxviii., 171.

** *Dingl. Polyt. Journ.*, clxiii., 182.

time caused by the breakage, the extra labour required, and a waste of acid, the money loss under these heads will be very considerable also.

In the face of these facts there would appear to be ample room for improvement. Messrs. Wm. Jones and John Walsh, of Middlesbro', have contrived and erected a new kind of decomposing furnace which completes the operation in one furnace. It has now been at work several months, and from an examination of the plates forming the dish of a furnace which was laid off a few days ago, I found the plates as fresh and good as when erected.

The furnace now in actual work, and from which fixed and regular results are obtained, consists of a metal dish divided into six segments, all tightly fixed together. The metal is 2½ inches thick, and the whole rests on solid brickwork. The diameter is 15 feet, and the charge of salt is about 12 tons each twenty-four hours; so that a furnace of this capacity will turn out about 80 tons sulphate of soda in six days. The batch is kept in constant motion by means of two cross metal arms worked from a centre shaft, to which are fixed paddles and rakes, and the whole mass is much more completely mixed than in a hand-worked furnace, and the sulphate produced is of a very fine and uniform character. Mr. Walsh, who is present, has kindly undertaken to explain the furnace more fully from the working model on the table and from the plans exhibited.

The motion supplied to the crown wheel is got from a donkey-engine, and a small engine with a 6-inch cylinder is found to be sufficient to work the furnace. At present the batch is both charged into the furnace and discharged by hand, but Mr. Goodman expects to perfect a plan to do this by machinery.

The advantages to be derived from this new furnace may be described as a more regular daily means of working; free from sudden stoppages by breakage of the present pans; a direct saving in wages, as only one workman is required to each shift for charging and working the furnace; a saving of fuel, as the heat required is less than in the old furnace; and 3 cwts. of coke per ton of sulphates is used in the place of 9 cwts. coal (= 5½ cwts. coke) by the old furnace; a saving, also, of sulphuric acid, calculated by Mr. Walsh to be equal to about 1½ to 2 per cent. Then, again, owing to the complete mixing and better working of the batch by machinery, the great inconvenience felt by the public living in the neighbourhood of chemical works by the batches being frequently drawn by the workmen in a partly finished state, and containing free hydrochloric acid, is entirely avoided. The fumes being emitted in a gradual and uniform manner throughout the working of the batch the condensation is more perfect, and as the whole of the gas is passed through one coke tower it is condensed into hydrochloric acid of 26° to 28° T., hot. It therefore appears that both in an economical and sanitary point of view this furnace is an improvement upon its predecessors.

In the description I have given I have purposely confined myself to a furnace in actual daily work, and from which known results have been obtained; but there is a fair probability that experience will show that not less than 100 tons weekly will be turned out of each furnace.

ACTION OF PEROXIDE OF HYDROGEN UPON FATTY OILS.

By S. COHNÉ.

By the action of HO_2 upon fatty oils they become separated into the two distinct classes known as drying and non-drying oils. Though HO_2 does not exhibit any action upon the latter description it acts powerfully upon the first kind. When a few drops of a weak solution of HO_2 (if containing only half a volume) are mixed and shaken with a drying oil—such, for instance, as linseed, nut, cotton-seed, poppy, &c.—linolic or palmatine acid are immediately separated from it, which, if put into a basin to settle, the linolic acid subsides to the bottom in the form of a greasy mass, while the palmatine acid sets in fine sheets upon the top of the oil. The remaining fluid oil loses its property of a drying oil, and becomes a non-drying oil.

Castor oil, after treatment with HO_2, does not then so readily dissolve in alcohol, and when dissolved in sufficient quantity of alcohol it will be found, if thrown on paper, that it will not dry up: consequently HO_2 is an easy test. If olive oil is adulterated with cotton-seed oil, this being a cheaper article, it may easily be detected, even if the adulteration is less than a quarter per cent, as the oil immediately becomes thick and dull.

The HO_2 appears to act upon the oil somewhat as sulphuric acid does upon alcohol, that is, the HO_2 is not decomposed, and when the solution of HO_2 is allowed to settle, and is afterwards drawn from the oil, it can be used again and again, and will continue to act upon a fresh quantity of oil with a like result.

The weak solution of HO_2 may remain for months under oil without being decomposed, even though heated up to 100° F.; similarly, as Saussure has found, that a layer of nut oil, if enclosed with oxygen gas, absorbs in eight weeks in the shade only three times its bulk of that gas. As drying oils are usually much cheaper than non-drying oils, advantage may be taken of the foregoing facts to convert the drying into non-drying oils for lubricating purposes.

NOTE ON THE ANALYSIS OF MINERAL PHOSPHATE OF CALCIUM.

By DR. B. W. GERLAND.

The "Oxalic acid method" is pointed out in the "Report on the Methods Employed in the Estimation of Potassa and Phosphoric Acid in Commercial Products, &c." (Chem. News, vol. xxxii., p. 172) as one of the most recommended. Its advantages are, however, considerably reduced when, as is mostly the case, iron and aluminium are present, and the choice is left between precipitating these as phosphates with an alkaline acetate before adding the oxalate, and the use of the citric acid for keeping them in solution. If the former recommendation is adopted, the difficulty is to obtain the iron and aluminium phosphates completely separated, and at the same time free from calcium phosphate; and if citric acid has been used the precipitation of calcium oxalate is incomplete, the magnesium ammonium phosphate is liable to be accompanied by basic magnesium citrate, and the estimation of iron and aluminium becomes inconvenient.

The precipitation of the phosphate of iron and aluminium from their acid solution by alkaline acetate is prevented by the presence of oxalic acid. On the strength of this fact the "oxalic acid method" can be modified, so that it becomes expeditious and accurate. The operations can be conveniently carried out in the following manner:—The properly-prepared solution of the weighed sample in hydrochloric or nitric acid is neutralised as much as possible without forming a permanent precipitate, heated to boiling, and oxalate added in small excess. If the dilution is already sufficient, oxalate of ammonium may be added in crystals. Acetate of sodium (or ammonium) is added in sufficient quantity to take up the free mineral acid, and the liquor is removed from the fire. The calcium oxalate settles rapidly as a heavy granular powder. The liquor, which appears clear whilst hot, becomes turbid on cooling, but after two hours' rest is again clear. The filtration of the calcium oxalate can now be proceeded with; it requires very little time. The precipitate is free

from iron and aluminium phosphates, which is readily proved by dissolving the calcined residuum in hydrochloric acid, and adding ammonia, when no precipitate will be formed.

From the filtrate and wash-waters of the calcium oxalate iron and aluminium are to be separated. Ammonia alone does not effect it completely, boiling assists it, and the addition of bromine-water still more; but, to make the separation complete, it is advisable to add ammonium sulphide, and allow the sample to stand in a warm place until the liquor has cleared itself, and assumed a bright yellow colour. It is then filtered with the known precautions. The precipitate is generally free from magnesia, particularly if ammonia was not added in too great excess, but contains, besides aluminium phosphate and iron sulphide, a not insignificant quantity of silica, even if the solution has been previously evaporated to dryness. Phosphoric acid retains silica with a tenacity similar to the vanadic acid. For the analysis of the iron and aluminium precipitate the molybdanic acid method is the most convenient. Instead of using ammonium sulphide, the liquor may be treated with chlorine, or evaporated with sodium carbonate, and the residuum calcined for the destruction of the oxalic acid. The filtrate from the ammonium sulphide precipitate is to be concentrated, and the magnesia precipitated with part of the phosphoric acid by ammonia. Lastly, the remaining phosphoric acid is separated by magnesia mixture.

With these modifications the "oxalic method" compares favourably in point of convenience with Sonnenschein's, and yields results no less accurate.

Macclesfield, March, 1876.

ON A REMARKABLE CASE OF MILK ADULTERATION.

By SYDNEY GIBBONS, F.C.S., Melbourne, Victoria

I VENTURE to apply the term "remarkable" to the case in question, because it is almost unique, being not only the first in my experience, but in addition only the second on record.

Almost all writers on adulteration mention many substances which they state to be used, but which each in turn admits that he has never detected. If this is found in the writings of professional investigators, can we be surprised if thoughtless and ill-informed paragraphers indulge, from time to time, in such intimations as that brandy is made with vitriol, champagne from petroleum, and fresh butter from river mud. Conspicuous among the instances of this blind faith in the unseen is the notion, constantly repeated, that milk is doctored or manufactured with sheep's brains. It is uniformly mentioned in "the books," but all of any repute admit the absence of foundation. The only evidence existing is that given by the late Prof. Quekett to a Committee of the House of Commons, in 1856. He stated that in one case, occurring five or six years before, he "found a sediment composed of nervous matter," but that since that time he had not been able to detect anything of the kind. In illustration, he submitted drawings of cow's milk, with and without the admixture of calves' brains. These drawings have passed into history, and are quoted by Dr. Hassall, who, though admitting that he has never found such an adulteration himself, gives an engraving of the microscopic appearance of the mixture, without, however, stating whether it is drawn from his own synthetic experiment or is a copy of Quekett's sketch.

My sample had been delivered the same day by a milkman serving a suburban hotel, at which complaints of the quality of the milk delivered had for some time been frequent.

At last it was bottled at once, much to the chagrin of the milkman, who, when informed that it would be forwarded to me for analysis, was eager to recover possession this, of course, was not allowed.

As received, the sample had separated into three layers, of which the upper was thick and of a brownish dirty grey colour; the bottom resembled it, but was less in volume; and the intervening portion was white and thin. On being shaken it resumed, without frothing, its thick and pulpy consistency, but soon separated again. Its density in this state was 1022, but in five hours fell by dissociation to 1016.

On standing it yielded, as before, an upper layer of thick grey pulp, of which most was at the top. It differed from cream, and showed but few large cream-cells. In amount it was, after standing the usual time, one-fifth of the entire column; but on allowing this to remain, I found the measurement to alter materially, and indeed the proportions subsisting between the several layers were by no means constant. The lower portion was darker, and included much dirt, with sand and vegetal *débris*; on its surface torulæ abounded. Throughout, and chiefly in the grey pulp, was much granular and clotted matter, which "took" magenta, and was thereby distinguished from the normal fat globules. There was no added starch, and nothing that depolarised light except the sand, some cuticles of grasses, and a few granules of their starches.

Many singular masses of the same type, but of varying size and form, somewhat resembling bean pods, having a length of from two to six times their width, behaving optically like fat corpuscles. Others were larger, irregular and branched, clear, structureless, not polarising, comparable in appearance to the vacuoles that form when a viscid medium dries up between glasses. Also many resembling caudate brain-cells (though not of the acute-angled and stellate forms), without apparent nuclei, not definitely tubular, and without contents. Some large transparent round cells or oil-globules, not natural. These bodies, and a large part of the mixture which had not previously shown structure, took magenta freely, and then revealed fragments of what appeared to be nerve tubules. A "large" piece, longer than the diameter of the field of view (0·015"), consisted of a ramification of tubules proceeding in the same direction, as having been normally parallel, but now partly spread radially, and connected by a fine transparent structureless tissue. Of this two sketches were made at different times. A notable feature was a sharp straight line, obviously a clean cut, which bounded it.

All these indications seemed to point to nerve structure, as of cerebral matter, and to nothing else. The next thing was actual comparison under both conditions. I procured some brains, and, after preparing an emulsion, got a series of similar and accordant observations. There was, however, this marked difference:—I did not succeed in producing a pulp so smooth as the milkman's, and always had a conspicuous amount of unbroken and unmistakable structures; whereas in the milk they had to be sought, but, saving the particular forms mentioned, they were to be found. It is probable that special precaution had been taken to break down as much as possible of the tissues by long digestion, and to strain off what proved intractable.

Besides these experiments, I brought into comparison published figures of the structures without number, and with singular agreement. For example, Hassall's drawing of the mixed milk might almost have done for one of my fields, except that I found more than he figures; and I find in the "English Cyclopædia," article "Nervous System," fig. 3, a fascicle of nerve fibres, which, if cut in half transversely, will give a very good rough idea of my fascicle described above. But my sketched example of this fascicle of tubules with their sheaths, sharply cut off, and the observations with magenta, are pretty conclusive evidence, and throw strong light on the other appearances.

There is, then, no room for regarding this otherwise

than as a veritable case of the adulteration of milk with brains, probably sheep's (which I long considered mythic), and the solitary successor of Prof. Quekett's memorable case in 1850.

It may be observed that I have refrained from using any of the expletives with which sensational accounts of such matters are sometimes garnished. I know that some accomplished analysts have, while declaring their opinion that this particular kind of fraud was not practised, stigmatised it as "disgustingly horrible." But I see nothing more necessarily disgusting in this use of brains than in its service with calves' head. And it certainly bears a closer dietetic relation to milk than some of the recognised substitutes; albeit, containing as it does substances more nearly resembling flesh food than those of milk alone, it might be too strong a food for infants.

But a preparation stealthily made for fraudulent purposes is not compounded with all the nicety of a well-appointed kitchen, and dirt is by no means the worst evil likely to be associated with such an adulteration. It is hardly likely that the proceeding will now be repeated; still I regret that it is not in my power to publish the name of the present offender.

ON SOME RESEARCHES ON THE PURIFICATION OF CAST-IRON.

By SERGIUS KERN, St. Petersburg.

The sample of cast-iron which was used during these experiments gave on analysis the following average composition:—

	Per Cent.
Silicon	2·76
Graphite	4·58
Carbon	1·20
Iron	90·40
Manganese	0·90
Sulphur	0·16
	100·00

This sample was melted in a small cupola, and the ingots obtained were analysed. The analysis showed that the amount of silicon and sulphur diminished and that a part of graphite was transformed into carbon. The results of this analysis are as follows:—

	Per Cent.
Silicon	1·50
Graphite	3·23
Carbon	1·98
Sulphur	0·05
Iron, &c.	93·24
	100·00

A second experiment was made; the sample of cast-iron was melted with a mixture of crude soda (1 per cent) and manganese dioxide (0·5 per cent). It was found that the resulting metal contained the following amount of silicon and sulphur:—

	Per Cent.
Silicon	0·58
Sulphur	0·02
Iron, &c.	99·40
	100·00

It was found well to add to the melted mixture a small quantity, about 3 per cent. of fluor-spar. Some metallurgists have proposed the use of soda for refining cast-iron; my experiments showed me that a modification of all these processes may be proposed, consisting of melting and refining the metal at the same time. The metal is melted in puddling or refining furnaces, and when the metal is fluid, into the furnace is thrown a mixture of 3 per cent of fluor spar, 1 per cent of crude soda, and 0·5 per cent of manganese dioxide for every 100 parts of the melted cast-iron. This process gave very good results.

MODIFICATION OF WANKLYN'S METHOD OF WATER ANALYSIS.

By H. B. CORNWALL, E.M.

To shorten the Nesslerising I keep on hand five bottles containing solutions in the proportion of 20, 15, 10, 5, and 2·5 c.c. of dilute standard ammonia solution (Wanklyn's "Water Analysis," 3rd ed., p. 25), filled up to 50 c.c. each with pure water, and then mixed with 2 c.c. of the Nessler reagent. I keep about 100 c.c. of the respective solutions in each bottle; they absorb ammonia, and become darker on use, but very slowly indeed.

Suppose it is required to determine the amount of ammonia in 50 c.c. of a distillate obtained by Wanklyn's ordinary method. It is collected in a test cylinder, and the usual 2 c.c. of the Nessler reagent run into it. After a minute or two, by pouring 52 c.c. from one or another of the comparison bottles into a second test cylinder, the amount of ammonia in the distillate can be roughly estimated by comparing the depth of color of the two liquids. If it is found that the distillate contains more ammonia than the solution made with 5 c.c. of ammonia solution, and less than that with 10 c.c, the comparison solution is returned to its bottle, and 10 c.c. of the above dilute ammonia solution, referred to on p. 25 of Wanklyn's book, is run into the second test cylinder, which is then filled to the 50 c.c. mark with pure water, 2 c.c. of Nessler reagent added, the whole stirred, allowed to stand five minutes, and then transferred to a burette in which tenths of a cubic centimetre can be accurately read. Now by running enough of this solution into the second cylinder to produce a colour as deep as that in the first and measuring the amount required, it is easy to ascertain by a proportion how many cubic centimetres of dilute ammonia solution have been required to produce this effect; in other words, how much ammonia is contained in the 50 c.c. of distillate. Suppose that 44·2 c.c. had been run out of the burette, then 52 : 44·2 : : 10 : 8·5.

The standard solution referred to in Wanklyn's work contains 0·01 milligramme of ammonia in one cub. centimetre, and the supposed 50 c.c. of distillate would therefore contain 0·085 milligramme.

The following are the results of the first six experiments made to test this method, the numbers representing milligrammes of ammonia per 50 c.c. of solution, as usual:—

0·0039	instead of	0·094
0·1827	,, ,,	0·179
0·1802	,, ,,	0·179
0·0183	,, ,,	0·017
0·0513	,, ,,	0·050
0·0501	,, ,,	0·050

By this means in ten or twelve minutes, at one operation and with a consumption of only 50 c.c. or less of water free from ammonia, the Nesslerising may be accomplished with an accuracy which, unless by lucky accident, one could not equal in half a dozen of the usual trials, each requiring eight or ten minutes and consuming 50 c.c., or a little less, of pure water. The test cylinders employed are 2·7 centimetres in diameter, of very thin glass, with perfectly flat bottoms, and certainly give more accurate results than I can obtain with the wider ones recommended by Wanklyn; per-

haps more accurate than are necessary for water analyses.

I have obtained quite good results by using the solution from my comparison bottles at once in the burette, but they grow darker with use. There is no need of cleaning the burette more than once in a morning, even if solutions of varying strengths are used, and unless the air of the laboratory is too bad for any such work, the solutions made up for use at any particular time may be used for all determinations that day, for which they are suitable, if kept meanwhile in tight bottles.

I have tried and am still trying to replace the comparison solutions by imitations of the yellow colour produced by mixing solutions of ferric chloride or platinic chloride with cobaltic nitrate, or by solution of burnt sugar, but with only partial success as yet. It is easy to imitate the depth of colour produced by a certain amount of ammonia, but on diluting the imitation liquids they do not give proportional results. In judging of the colours in the test cylinders, I prefer to hold them so that the bottoms of the cylinders are half over a white and half over a black surface; the dark part seems to heighten the contrast between the lighter portions.—*American Chemist.*

PROCEEDINGS OF SOCIETIES.

PHYSICAL SOCIETY.

March 25, 1876.

Professor G. C. Foster, F.R.S., President, in the Chair.

The following candidates were elected members of the Society:—Prof. Liversidge, The Marquis of Salisbury, W. Ackroyd, Tolver Preston, W. Merritt.

Mr. O. G. Lodge, B.Sc., made a communication on "*The Flow of Electricity in a Plate*," in continuation of a paper which he read before the Society, on the 26th of February. In order to apply the principle of images already described to the flow of electricity in plates bounded by straight lines, it is necessary that the angles of the plate should be aliquot parts of 180°; and, since this condition excludes obtuse angles, the number of rectilinear figures which can be treated is very limited. They are rectangles, equilateral triangles, two cases of right-angled triangles, the two limiting cases of isosceles triangle, for which the equal angles are 0° and 90° respectively and many cases of the general two-sided polygon or "wedge," including the regular two-sided polygon or "strip." Since the images of a pole in a wedge lie on a circle as in a Kaleidoscope, Cotes's property of the circle may be applied to obtain expressions for the potential of any point, and for the electrical resistance of the plate to the flow from any number of point-poles situated anywhere in it. The expressions are rather long, but they become simpler in certain special cases which were pointed out. Making the angle of the wedge vanish, the expressions modify into corresponding expressions for the strip, the resistance expressions of which always contain hyperbolic trigonometrical functions of the positions of the poles. The potential function for a circular sector also follow from the general case of the wedge. The general resistance formula applied to the case of the isosceles right-angled triangle leads to some continued products, all of which are generalisations of Wallis's expression for $\frac{\pi}{2}$. The product of these products, which is itself of the same form, has been reduced by Mr. J. W. L. Glaisher to the complete elliptic integral usually denoted by K, its modulus being sin 45°. This quantity appears in all the resistance expressions for right-angled triangles and squares which the author has yet examined. The case of an equilateral triangle leads to more complex and interesting products, which were reduced by Mr. Glaisher to the product of two theta-functions with $\sin \frac{\pi}{7}$ as a modulus. When the conditions of flow are known in one rectilinear figure, they may be extended to a large number of others by alternate processes of reflecting the plate in one of its own boundaries and of cutting it along one of its straight flow or equipotential lines. Diagrams of such transition figures were shown. In order to obtain the resistance of a compound conductor by means of the known resistance of its components, it is necessary that the flow conditions in each component shall remain entirely unaffected by their being connected together. Thus, if the resistance of a circuit consisting of two wires side by side is to be deduced from the resistance of the wires separately, by the ordinary method of adding their conductivities, it is necessary either that the wires shall not touch each other, or that, if they do, no flow shall pass across the junction. This rule is often overlooked, and the oversight has given rise in certain cases to a notion of electrical "interference." The concluding part of the paper has to do with the flow conditions when line poles are combined with point poles in a sheet, especially when point electrodes are introduced into a sheet in which a uniform current or "river" is flowing across the sheet.

Dr. Guthrie referred to experiments which he had made on the subject with the aid of a magnetic needle, but the results were of course interfered with by the lines of flow. He suggested as another subject deserving of investigation, the flow of electricity through a network of wires, which might perhaps be considered as a case of one dimension.

Mr. Lodge had not investigated such a case, but thought it would rather be an extremely complicated case in two dimensions, somewhat resembling a plate with many holes in it.

Prof. Foster pointed out the extreme simplicity of the ideas employed to obtain the results which had been given. The subject has often been treated by mathematicians, but too often without regard to the physical point of view.

Dr. Guthrie then communicated a fourth paper on "*Salt Solutions and Attached Water.*" It consists mainly of an account of an examination of the behaviour of a salt solution when cooled below the freezing-point of water. Having shown in previous communications that every salt solution, when of a certain strength, solidifies as a whole at a certain temperature as a cryohydrate, the present research was directed to the determination of the temperatures at which (1) ice separates from solutions of strengths weaker than the cryohydrate, and (2) the anhydrous salt, or some hydrate richer than the cryohydrate, separates from solutions stronger than the cryohydrate. About twenty typical salts have been examined in this manner, and curves were exhibited, in which the abscissæ represent strengths and the ordinates solidification temperatures. All the curves have a similar character, and exhibit a point of contrary flexure between the origin, representing pure water at 0° C., and the cryohydrate. Between the cryohydrate and the 0° C. degree of saturation, they are nearly straight lines, and are continuous with the curves of solubility above 0° C. The joint effect of two salts in depressing the temperature of ice-formation was also examined. From previous experiments the general law that the temperature of a freezing mixture is identical with that of the solidification of the cryohydrate of the corresponding salt appeared not to be the case with iodide of sodium. It now appears that this salt offers no exception to the general law and that the what was previously mistaken for the cryohydrate is really a sub-cryohydrate solidifying at a higher temperature. Certain remarkable cases of supersaturation were discussed which show that a solution may be supersaturated in a three-fold manner—(1) With regard to ice;

(2) with regard to a salt; (3) with regard to the cryohydrate of the salt. The parallelism between a boiling saturated salt solution and a glaciating one was pointed out.

Prof. Foster explained that when we have discontinuity in a curve we always must be dealing with two separate phenomena. He mentioned also that the portion outside the part of the curve between zero and the cryohydrate must be taken as representing supersaturation of ice, and that outside the upward curve from this point refers to supersaturation of salt.

NOTICES OF BOOKS.

Remarks on Coal and Other Matters. By I. was. Thompson, M.R.C.S. Newcastle-upon-Tyne: "Daily Journal" Office.

A collection of essays in which a certain amount of truth—chemical and otherwise—is conveyed in a very original, not to say eccentric manner. We quote the author's instructions for finding the comparative value of different samples of coal. The apparatus required is a small cast-iron crucible, about the size of a common tea-cup, and furnished with a lid. This crucible should be as light and thin as possible. The one the author now uses weighs 6 ozs., holds 4 ozs. of water, and cost one shilling. Having obtained a fair sample of the coal—which is rarely practicable except 1 cwt. has been crushed under edge-stones—we reduce an ounce of this to an impalpable powder, and carefully mix 10 grs. of this with ½ oz. troy of common salt, previously dried, and then add and thoroughly mix with this 1 oz. troy of bichromate of potash; place the mixture in the crucible, put on the lid, counterpoise the whole with great care in the scales; then, allowing the counterpoise to remain, place the crucible in a common fire where it may become dull red-hot, and allow it to continue so for a quarter of an hour; after which take the crucible from the fire, and when cold place it again in the scales, and notice how many grains it has lost; then, deducting from this the weight of the coal (10 grs.), the remainder represents the quantity of oxygen carried off by the really useful combustible constituents of the coal. This he has found to vary in the coals supplied to the London market from 19 to 28.

The essay on "Pure Water and Sanitary Reform" will, we fear, be considered in certain influential quarters as little short of blasphemous. The Society of Medical Health Officers, he remarks, tell us that the drinking waters supplied to London have been remarkably free from organic pollution. "Unfortunately there is another Aquarius, a kind of Government official and eminent chemist, who, during part of the very same period, declares that the five companies which take their supply from the Thames sent out water quite unfit for domestic use, and containing large quantities of suspended impurities, fungoid fibres, moving organisms, and soluble brown matter." The author not only asks the old plain question, "Who is to disagree when doctors differ?" but points out that the inhabitants who have swallowed all these pollutions have enjoyed just as good health as those who have had the benefit of the Kent Company's water, "pure, brilliant, and palatable." "As a nation," says Mr. Thompson, "we are getting into the ruinous practice of keeping more cats than we have mice to be caught, the result of which is to induce our sanitary cats to make work for themselves by creating sensational mice." "Up to the present time sanitary reform has not only shown itself to be totally useless and frightfully expensive, and it is in fact a greater nuisance than the nuisances which it pretends to remove." This view, if exaggerated, is not without a certain element of truth. It may serve as an instance of the reaction which sanitary reformers of the sensational school have succeeded in creating not merely in the minds of the interested and the ignorant, but in those of the scientific and thoughtful. Mr. Thompson's pamphlet contains much that will be called in question, but few can deny that it is highly suggestive, and may be read with much profit.

The Geological Record for 1874. An Account of Works on Geology, Mineralogy, and Palæontology Published During the Year. Edited by William Whitaker, F.G.S. (of the Geological Survey of England). London: Taylor and Francis.

This Annual supplies a want which must have been felt by all engaged in geological research, and deserves general encouragement. The books and memoirs referred to are classified under the heads of stratigraphical and descriptive geology, physical geology, including cosmogony, applied and economic geology, petrology, mineralogy, and palæontology. Under the title of each is found a brief abstract of its nature and contents. There are appended a list of the guarantors of the undertaking, among whom we find many names illustrious in science, a table of the works, periodicals, and memoirs referred to, and a copious index. We wish the editor and his colleagues the fullest measure of success.

Artizans' and Labourers' Dwellings Improvement Act, 1875: Report to the Honourable the Commissioners of Sewers of the City of London. By W. S. Saunders, M.D., F.S.A. London: Skipper and East.

The author gives an account of the areas which he finds to be in a bad sanitary condition, and which he recommends to be dealt with as provided in the Act. As might be expected, some interesting facts are brought to light. Thus, in Holborn Buildings, 48 rooms are inhabited by 160 persons; in Crown Court, Golden Lane, 60 rooms are tenanted by a population of 360, or six persons to a room! In the same district 1231 persons live in an area of 60,000 square feet, so that very little more than 6 feet by 8 falls to the share of each. In Holborn Buildings there is only a space of 5 feet by 5 per person. Altogether some 10 acres contain 5546 persons. But it is evident that the vital conditions are very much worse than might be inferred from the mere ratio of space to population. Dr. Saunders, without going into details, remarks that "whatever ventilation these houses once possessed has been so seriously curtailed that the air surrounding them remains stagnant and vitiated and teems with myriads of animal and vegetable germs, the woodwork and other absorbing surfaces of the houses have become supersaturated with the living and decaying organic matter emanating from the persons, excreta, refuse, and diseases of the people who occupy them." Would it not be very desirable that whenever similar "property" is swept away all the woodwork should be consumed by fire, as suggested, if we mistake not, by Mr. Wanklyn? It is to be hoped that the recommendations of Dr. Saunders will be fully carried out. The pamphlet is illustrated with plans of the condemned districts.

CORRESPONDENCE.

WHITE CAUSTIC SODA.

To the Editor of the Chemical News.

Sir,—I shall be glad if you will allow me to make a few remarks upon the paper by Mr. G. E. Davis, "On the Manufacture of White Caustic Soda." It appears that the name of the original inventor of the process is not

generally known, and I think it right to state what I know of this subject. When, in July, 1860, I was appointed chemist to Messrs. Evans and McBryde, Union Alkali Works, St. Helens, Mr. McBryde informed me that a year before he had heated caustic soda in the pots to redness, and that when this temperature was reached oxide of iron separated out and coloured the whole mass red. It was then run into a second pot to cool, and on breaking the solidified mass, Mr. McBryde found, to his astonishment, that the oxide of iron had completely deposited, leaving on the top a thick layer of perfectly white caustic soda. At Mr. McBryde's request I continued these experiments, and the process was soon so far perfected that for the first time white caustic soda was sent into the market. Mr. McBryde did not foresee the great commercial importance of this manufacture, and with his consent I published the details of this process as interesting from a scientific point of view, showing at the same time that not only the oxide of iron, but also all the alumina separates out, while on the other hand caustic lime may be dissolved in a large quantity in red-hot soda.

At the meeting of the British Association, in Manchester, 1862, I exhibited a large sample of this white caustic soda, and it was then generally ackowledged to be a perfectly new commercial product.—I am, &c.,

PH. PAULI, Ph.D.

Chemische Fabrik, Rheinau,
Near Mannheim, March, 1876.

TREATMENT OF ANTHRACEN OIL.

To the Editor of the Chemical News.

SIR,—I was pleased to see in the CHEMICAL NEWS (vol. xxxiii., p. 99) an article on the above subject, by A. McDonald Graham, F.C.S., and hope that the suggestions offered will be the means of eliciting valuable information from the numerous chemists who must now be working at the subject, it being evident, from the high price which tar commands, that the treatment of the various oils produced in the distillation of tar needs to be carried on in a more economic and practical method than hitherto.

The method of obtaining the anthracen from the oil, by what we may call the residual method, has been known to myself, and I have no doubt to other chemists, for a number of years, but, as far as I can learn, has only been employed in the laboratory, all attempts to work the method practically having resulted in the production of a black greasy mass, often pitchy, and very difficult to filter. In the laboratory I have always found the residual method to give a cake testing 5 to 10 per cent more by the anthraquinon test than the cake obtained in the usual way by direct distillation, and in the majority of cases a larger yield of cake.

If some method could be devised by which a clean residue, easy to filter, could be obtained in the works, there is no doubt that this method would be generally adopted.

There are one or two points in Mr. Graham's article in which I fail to comprehend his meaning. Thus he says—"The quantity of real anthracen contained in the distillate varies according to the nature of the oil operated on; but it is usually very small, amounting on an average to about 12 per cent." Here I presume he means the quality of the anthracen cake produced therefrom; still one would be led to infer from his statement that the distillate yields 12 per cent of real anthracen,—but as this would mean a yield of about 2½ cwts. of real anthracen per ton of the distillate, this cannot be the case.

Again, he says—"The solid portion deposited in the tank will now be found to contain at least 17 per cent of real anthracen, and will be much easier to treat either by fractional distillation or washing." Mr. Graham here writes as if the method produced anthracen cake ready the market, without the use of filter or press: but even if he did produce such a cake, which I question, what is the utility of treating 17 per cent anthracen by fractional distillation? Why not state the quality and quantity of anthracen cake produced from a given bulk of oil, and the comparative yields by the residual and direct method of distillation, also the specific gravity of the various oils operated on.—I am, &c.,

WILLIAM W. STAVELEY.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences. No. 10, March 6, 1876.

Absorption of Bicarbonates by Plants in Natural Waters.—M. A. Barthélemy.—The author concludes that there are roots capable of absorbing dissolved gases, and likewise roots destined for the absorption of liquids and of dissolved mineral bodies. The quantity of bicarbonates absorbed is in proportion to the amount of water taken up, varying also with the nature of the plant. The roots of plants excrete carbonic acid, which maintains the bicarbonates in a state of saturation.

White Fumes Given Off by a Blast-Furnace in the Neighbourhood of Longwy.—M. L. Gruner.—The ores treated in this furnace are obtained from the ferruginous oölite, and have an argillaceo-calcareous gangue. The deposit from the dense white fumes consisted of—

Sulphate of potash	0·3782	
Carbonate of potash	0·0390	
Chloride of potassium	0·0152	
Soluble silica	0·0012	
Soluble in water	——	0·4336
Silica	0·2298	
Lime	0·1588	
Alumina	0·0962	
Ferrous oxide	0·0400	
Manganous oxide	0·0016	
Magnesia	0·0036	
Sulphur (not determined)	—	
Insoluble in water	——	0·5300
Hygrometric and combined water		0·0320
		0·9956

The slag produced is basic, and is readily attacked by hydrochloric acid.

Action of Electrolytic Oxygen upon Glycerin.—M. Ad. Renard.—The product obtained is glyceric aldehyd, $(C_3H_6O_3)_4H_2O$.

Note on Inverted Sugar.—M. E. J. Maumené.—A continuation of the controversy with M. Dubrunfaut.

Justus Liebig's Annalen der Chemie,
Band 180, Heft 1 and 2.

Contributions to a Knowledge of the Condensation-Products of Aceton.—L. Claison.—The author concludes that the formation of mesitylen from the condensation-products of aceton is preceded by their re-solution into aceton or its derivatives. Mesitylic oxide and phoron are not intermediate products of the formation of mesitylen. The mesitylic oxide which accompanies mesitylen must be regarded as a secondary, but not as an intermediate product.

Researches from the Laboratory of the University of Tubingen.—Communicated by R. Fittig.—These re-

searches consist of—"Contributions to a Knowledge of the Chinons," by R. Fittig and W. Siepermann; "On the Constitution of Terebic and Pyro-terebic acids," by B. Mielck; and "On the Oxidation Products of Terpin," by Carl Hempel.

Communications from the Chemical Laboratory of Griefswald.—These include papers on the constitution of the three amido-sulpho-benzolic acids, by H. Limpricht; on para-bromo-sulpho-benzolic acids and on para-chloro-sulpho-benzolic acid, both by C. Goslich; and on meta-chloro-sulpho-benzolic acid, by E. Kieselinsky.

Communications from the Laboratory of Prof. V. Meyer, of Zurich.—These papers consist of researches on the differences of the primary, secondary, and tertiary nitro compounds, and include the following:—On the bromo derivatives of the nitropropans, by V. Meyer and J. Tschermak; on the preparation of mono-bromated nitro compounds of the fatty series, and on the bromo-substitution products of nitro-methan, by Dr. J. Tschermak; on the pseudo-nitrols, the isomers of the nitrolic acids, by V. Meyer and J. Locher; on tertiary nitrobutan, by Dr. J. Tschermak; on the action of acids upon nitro compounds of the fatty series, by V. Meyer and J. Locher; on methyl-nitrolic acid, by J. Tschermak: on the action of tin and hydrochloric acid upon ethyl-nitrolic acid and nitroform, by V. Meyer and J. Locher; researches on the constitution of ammonium compounds and of sal-ammoniac, by V. Meyer and M. Lecco; and on the quantivalence and combining power of carbon, by V. Meyer.

Oxidation of Carboniferous Compounds.—E. Erlenmeyer, O. Siegel, and L. Belli.—The authors have examined the oxidation of the butyric acid of fermentation by means of nitric acid, and that of the capronic acid (of fermentation) of succinic and oxalic acid as produced by the same agent.

Tannic Acid of the Hop.—Carl Etti.—The tannin of the hop seems to be nearly related to, if not identical with, the tannins of oak-bark, of ratanhia-root, of the rhizomer of *Filix mas*, and of the bark of *China nova*. It is not to be regarded as an acid, but as a compound ether.

Pachnolite of Greenland.—(From the *Transactions of the Royal Academy of Sciences of Gottingen.*)—Pachnolite may be regarded as a hydrated cryolite, in which two-thirds of the sodium are replaced by calcium. Its composition is—

Aluminium	13·43
Calcium	17·84
Sodium	10·75
Water	8·20
Fluorine	49·78
	100·00

It occurs along with cryolite.

Note to the Paper on Diphenylen-Disulphide contained in these "Annalen," 179, p. 178.—C. Græbe.—A brief note referring to the date of the first discovery of diphenylen-disulphide.

Certain Compounds of Ether with Anhydrous Metallic Chlorides.—P. P. Bedson.—An inaugural dissertation read at Owens College, Manchester.

Occurrence of Palladium, Platinum, and Selenium in Silver Coins.—Dr. H. Rössler.—An account of the methods used in the Frankfort refinery for the separation of the above-mentioned bodies.

Conversion of the Hydrocarbons of the Ethylic Series into the respective Alcohols.—A. Butleroff.—Not adapted for abstraction.

Hyawa Resin.—J. Stenhouse and C. E. Groves.—Derived from an English source.

Compounds of Phenol with Neutral Salts of Quinine.—J. Jobst and O. Hesse.—The authors have obtained and analysed the phenol-sulphate, phenol-hydrochlorate, and phenol-hydrobromate. They find that in these compounds the carbolic acid has lost its corrosive and poisonous properties, still retaining its useful attributes. They suggest the use of these compounds in typhus.

Gazzetta Chimica Italiana.
Anno vi., 1876, Fasc. i.

Synthesis of Sulphuretted Tannic Acids.—Ugo Schiff.—A lengthy memoir, incapable of useful abstraction.

Elasticity of Metals at Different Temperatures.—G. Pisati.—The first chapter only of this paper is given, treating on the elasticity of iron and steel at different temperatures.

Modification of the Process for the Separation of Poisonous Alkaloids from the Intestines.—F. Selmi.

Method of Detecting Traces of Phosphoric Acid in Toxicological Investigations.—F. Selmi.—These two papers are reserved for insertion in full.

Action of Iodide of Allyl and Zinc upon Oxalic Ether.—E. Paterno and P. Spica.—The reaction yielded an oily body containing 64·74 per cent of carbon and 8·96 of hydrogen.

Chemical Researches on Twelve Solid Colours found at Pompeii.—P. Palmieri.—The author identifies ten of the specimens with the following colours, referred to by Pliny:—Ochra, rubrica, minium secundarium, sinopis, ærugo, viride Appianum.—A rose colour appeared to be a lake consisting of mineral matter—chiefly alumina combined with a nitrogenous organic body. Its reactions were not very different from those of cochineal and madder lakes. The author concludes that it is a compound of the celebrated purple dye of antiquity, mixed possibly with the colouring-matter of kermes and of madder. On some future occasion we may give this interesting paper in full.

Les Mondes, Revue Hebdomadaire des Sciences,
No. 10, March 9, 1876.

This issue contains no chemical matter.

Reimann's Farber Zeitung,
No. 8, 1876.

Solutions of Egg Albumen.—At 17·5° solutions of egg albumen contain, according to G. Witz, the following proportions of solid albumen (with 15 per cent of hygroscopic water):—

Albumen Per cent.	Degree of Baumé.	Specific Gravity.
1	0·37	1·0020
2	0·77	1·0054
3	1·12	1·0090
5	1·85	1·0130
10	3·66	1·0261
15	5·32	1·0384
20	7·06	1·0515
25	8·72	1·0644
30	10·42	1·0780
35	12·12	1·0919
40	13·76	1·1058
45	15·49	1·1204
50	17·10	1·1352
55	18·90	1·1511

No. 9, 1876.

Referring to the sensational *canards*, circulating in political and literary papers, about poisonous dye-wares

and their dreadful effects, Dr. Reimann advises dyers and printers to challenge the propagators of such stories to prove their truth.

Retoration of Albumen.—Albumen is rendered partially insoluble and useless for printing by a variety of causes, such as long standing, heating above 35°, &c. G. Wagner treats it then with parings of the stomach of calves at blood-heat. He takes 400 grms. of the albumen, 30 of calves stomach, washed in cold water and cut up into square pieces, and adds them to 1 litre of water acidulated with 10 grms. of hydrochloric acid. After 36 hours he strains and neutralises with ammonia. The solution of albumen is then again fit for use. G. Witz effects the same process with the stomach of sheep, digesting in the acidulated liquid at 40° for 40 hours. With pepsin, colours fixed with albumen on printed goods may be removed. In like manner the starch may be removed from tissues not well finished by treatment with malt, which converts it into sugar. This process is preferable to boiling. Pepsin acts equally well upon the albumen of eggs and of blood.

Removal of Burls from Wool and Cloth.—Introduce the wool or the woollen goods into 100 litres of suphuric acid at 6° B. in which 500 grms. alum, 250 grms. salt, and 50 grms. of borax have been dissolved. Work in this bath for one or two hours, drain in the centrifugal, and hang up at 100° to 120°. Wash for 1½ hours in clear water, treat for 2 hours with fuller's earth, soda, and lime, and wash again for 2 hours. Sulphuric acid is adapted only for whites and indigo blues. For coloured goods solutions of chloride of tin and chloride of manganese (?) at 6° B. are recommended. The editor points out that the addition of borax is absurd.

No. 10, 1876.

The Association of German Distillers is about to establish, in Berlin, a college for the especial cultivation of the branches of service bearing upon their business.

G. Ruckensteiner calls attention to the destructive action of animal and vegetable oils upon steam engines and boilers. Steam at high pressure decomposes these bodies and liberates fatty acids, which, as he has proved by an extended series of experiments, attack the iron. He recommends the use of mineral oils boiling at high temperatures.

The dyeing-receipts in this issue contain nothing noteworthy.

No. 11, 1876.

Vanadium for Aniline Black.—A friend in Rouen announces that aniline blacks with vanadium are there in use on a large scale. Per litre of colour 0·001 gramme, or 1 milligramme of the vanadiate of ammonia is employed, *i.e.*, the one-millionth part. Sulphide of copper, &c., are no longer thought of. Aniline salts, chlorate of potassa and vanadiate of ammonia—that is all. The misfortune is the scarcity of the vanadium preparations. The colourists of Rouen are already studying another aniline black which can be really dyed upon linen, cotton, silk, and wool, and without damaging the fibre. A new method has also been discovered in Rouen of fixing the aniline colours along with madder colours, but without albumen. Thus the important albumen question may perhaps be got rid of altogether.

It must be confessed that the colourists of Rouen produce far more novelties than their colleagues in all the rest of the world. What can be the cause? Simply that most of them have had a thorough scientific training. And how do they obtain there colourists scientifically trained? Because France, in spite of its defective system of elementary education, possesses excellent schools for specialities in which youths are not "crammed" but scientifically prepared for their future callings. This is the point in which we require reformation. (If Germany makes such a confession what must England say? We have often maintained that it is not elementary, but technico-scientific education which is wanted if we are to preserve our national manufacturing pre-eminence. We want more inventors, not more readers and writers.)

NOTES AND QUERIES.

*** Our Notes and Queries column was opened for the purpose of giving and obtaining information likely to be of use to our readers generally. We cannot undertake to let this column be the means of transmitting merely private information, or such trade notices as should legitimately come in the advertising columns.

Mineralogy.—Can you inform me of the best and most complete works on mineralogy and applicability of minerals, ores, &c., to manufactures, and where obtainable?—Geo. G. Blackwell.

Infusing Tea.—Since no one has answered the query upon this subject, may I suggest that it is perhaps owing to the escape of dissolved gases that water which has been kept in a state of ebullition does not make such good tea as water just upon the boil. I once made some experiments to try the truth of this supposition, and found that water boiled for ten minutes through which a brisk stream of CO_2 was passed did not differ so much in its effects upon the tea as when the water was boiled for a similar length of time without the addition of the CO_2.—A. P. S.

MEETINGS FOR THE WEEK.

Monday, 3rd.—Medical, 8.
—— Royal Institution, 2. General Monthly Meeting.
—— London Institution, 5.
—— Society of Arts, 8. Cantor Lectures. "Wool Dyeing," by George Jarmain.

Tuesday, 4th.—Civil Engineers, 8.
—— Royal Institution, 3. "On the Classification of the Vertebrated Animals," by Prof. Garrod.
—— Zoological, 8.30.

Wednesday, 5th.—Society of Arts, 8. "The Cultivation in India of Caoutchouc-yielding Trees," by Clements R. Markham, C.B.
—— Geological, 8.
—— Microscopical, 8.
—— Pharmaceutical, 8.

Thursday, 6th.—Royal, 8.30.
—— Royal Institution, 3. "Polarised Light," by Mr. Spottiswoode.
—— Royal Society Club, 6.30.
—— London Institution, 7.
—— Chemical, 8. "Note on the Action of Sulphuric Acid on Naphthalen," by Mr. C. E. Groves and Dr. Stenhouse. "Notes from the Laboratory of the Yorkshire College of Science," by Prof. Thorpe. "On Systematic Nomenclature," by Dr. Armstrong. "On the Manufacture of Sulphuric Acid on the Large Scale, Experimentally Illustrated," by Dr. Messel and Mr. Squire. "On the Action of Certain Metallic Chlorides upon Benzene, Toluen, and Naphthalen at High Temperatures," by Mr. Watson Smith.

Friday, 7th.—Royal Institution, 9. "Ordeals and Oaths," by E. B Tylor.
—— Geologist's Association, 8.

Saturday, 8th.—Royal Institution, 3. "Wagner," by Mr. Dannreuther.
—— Physical, 3.

THE
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Correspondence, Notices of Scientific Works, Progress of the Various Sciences, &c., &c.,

London: 3, Horse-Shoe Court, Ludgate Hill, E.C.

THE CHEMICAL NEWS.

VOL. XXXII. No. 854.

ON REPULSION RESULTING FROM RADIATION.*

By WILLIAM CROOKES, F.R.S., &c.

PART IV.

(Concluded from page 131).

The Measurement of the Force.

THE author describes a torsion-balance in which he is enabled to weigh the force of radiation from a candle, and give it in decimals of a grain. The principle of the instrument is that of W. Ritchie's torsion-balance, described in the *Philosophical Transactions* for 1830. The construction is somewhat complicated, and cannot be well described without reference to the diagrams which accompany the original paper. A light beam, having 2 square inches of pith at one end, is balanced on a very fine fibre of glass stretched horizontally in a tube, one end of the fibre being connected with a torsion-handle passing through the tube, and indicating angular movements on a graduated circle. The beam is cemented to the torsion-fibre, and the whole is enclosed in glass and connected with the mercury-pump and exhausted as perfectly as possible. A weight of 0·01 grain is so arranged that it can be placed on the pith or removed from it at pleasure. A ray of light from a lamp reflected from a mirror in the centre of the beam to a millimetre-scale 4 feet off shows the slightest movement. When the reflected ray points to zero, a turn of the torsion-handle in one or the other direction will raise or depress the pith end of the beam, and thus cause the index ray to travel along the scale to the right or to the left. If a small weight is placed on one end so as to depress it, and the torsion-handle is then turned, the tendency of the glass fibre to untwist itself will ultimately balance the downward pressure of the weight, and will again bring the index ray to zero. It was found that when the weight of the 1-100th of a grain was placed on the pith surface, the torsion-handle had to be turned 27 revolutions and 353°, or 10,073° before the beam became horizontal. The downward pressure of the 1-100th of a grain was therefore equivalent to the force of torsion of the glass thread when twisted through 10073°.

The author next ascertained what was the smallest amount of weight which the balance would indicate. He found that 1° of torsion gave a very decided movement of the index ray of light, a torsion of 10073° balancing the 1-100th of a grain, while 10074° overbalanced it. The balance will therefore turn to the 99-100,000,000th of a grain.

Divide a grain weight into a million parts, place one of them on the pan of the balance, and the beam will be instantly depressed.

Weighed in this balance the mechanical force of a candle 12 inches off was found to be 0·000444 grain; of a candle 6 inches off 0·001772 grain. At half the distance the weight of radiation should be four times, or 0·001776 grain; the difference between theory and experiment being only four-millionths of a grain is a sufficient proof that the indications of this instrument, like those of the apparatus previously described by the author, follow rigidly the law of inverse squares. An examination of the differences between the separate observations and the mean shows that the author's estimate of the sensitiveness of his balance is not excessive, and that in practice it will safely indicate the millionth of a grain.

One observation of the weight of sunlight is given: it was taken on December 13; but the sun was so obscured by thin clouds and haze that it was only equal to 10·2 candles 6 inches off. Calculating from this datum, it is seen that the pressure of sunshine is 2·3 tons per square mile.

The author promises further observations with this instrument, not only in photometry and in the repulsion caused by radiation, but in other branches of science in which the possession of a balance of such incredible delicacy is likely to furnish valuable results.

* Abstract of a paper read before the Royal Society, Feb. 10, 1876.

ON THE ANALOGY OF CYANOGEN TO OXYGEN.*

By WILLIAM SKEY,
Analyst to the Geological Survery of New Zealand.

I HAVE to preface my remarks upon this subject by the statement that they are entirely of a theoretical nature, and therefore unsupported by the results of that kind of experimental research, the details of which it will be remembered have hitherto constantly formed the groundwork of those previous papers of mine read before you; however, for this once I must beg your kind indulgence for a hearing upon that which, if it has any value, owes it to chemical researches and chemical records, long since accumulated by other chemists.

Presuming, then, upon your indulgence, I will at once state that the subject of this paper is the true position of a certain compound body among the elements as deducible from its known chemical reactions, that now assigned to it being, I think, incorrect.

The great importance of interpreting those facts correctly by which we compare our imitative with our real elements is so obvious to those anxious to apprehend more of the true nature of the elements than at present we do, that I need not excuse myself for bringing such a matter as this before you.

The substance, the supposed position of which I take exception to, is cyanogen, a compound, as you are aware, of carbon and nitrogen in equivalent quantities. It and a number of other compounds into which it enters are now classed indiscriminately and collectively with the chlorine group as salt radicals, but to cyanogen itself "par excellence" is attributed this character.

That this is in reality the position assigned to cyanogen is indisputable. Brand and Taylor, in their excellent work on chemistry, designate this substance as a compound radical, and associate it with chlorine, bromine, and iodine for reasons I shall presently show. Prof Roscoe, too, in his "Elementary Chemistry," 1871, describes cyanogen in terms which certainly have a tendency to keep it so classified. The special grounds upon which cyanogen is classed with these radicals are, I believe, as follows:—

(1.) That it and its hydride combine directly with the least oxidisable metals generally, as gold and silver.

(2.) That it also combines with hydrogen, and forms with it a compound analogous to hydrochloric acid.

(3.) That when passed into a solution of any caustic alkali it is in part oxidised, alkaline cyanates and cyanides forming.

(4.) That when cyanides are electrolysed the radical is evolved at the positive pole.

If to this we add that cyanide of potassium crystallises in cubes, as do the chlorides, bromides, and iodides of this base, I think we exhaust the evidence which can as yet be alleged in favour of the analogy of cyanogen to the elements referred to.

* Read before the Wellington Philosophical Society.

Such are the reasons for classifying cyanogen with these radicals, and I will now go over them *seriatim*.

In the first place it is true that cyanogen combines directly with the least oxidisable metals, but so does oxygen when in the allotropic state, also sulphur at a slight elevation of temperature, and, further, its hydride (sulphuretted hydrogen) imitates hydrocyanic acid in presence of the metals instanced. Oxygen and sulphur should therefore on this principle be admitted along with cyanogen into the group of radicals, which would be absurd, as they are not admitted as radicals at all; therefore these tests are unreliable.

In the second place, besides cyanogen, sulphur and a number of other elements combine readily with hydrogen, the bulk of which are not halogens, while, in reference to the supposed analogy existing between hydrocyanic and hydrochloric acids, I really fail to see any grounds for this.

Hydrochloric acid is a very strong one, intensely acid, and forms salts with the alkaline metals which are quite neutral. Hydrocyanic acid, on the other hand, if acid at all (which I doubt), is so feebly so that "it scarcely affects the blue litmus paper;" indeed I believe it to be neutral, as any minute acid reaction which has been obtained in respect to it may be due to carbonic acid, hydrocyanic acid being very prone to decompose with evolution of carbonic acid.

Further, in accord with this, the salts of cyanogen with the alkaline metals are not neutral, as are the corresponding salts of the chlorine group, but strongly alkaline.

In reference now to the third supposed joint characteristic of cyanogen and the radicals to which it is compared, we can parallel this in the case of sulphur and phosphorus. Thus, either of these elements, when warmed with a solution of any caustic alkali, forms oxygenated and haloidal salts, a part of them being oxidised at the expense of the oxygen of the alkali, as in the case of cyanogen, chlorine, &c., under these circumstances.

Lastly, as to the polar affinities of cyanogen and the crystalline form of its potassium salt. Sulphur and oxygen, when liberated by voltaic action, also detach from the negative pole; while, in reference to the similarity in the crystalline forms of cyanide of potassium to the chloride, so many substances crystallise in the same form, though these are of a widely different nature, that, as a single test of position, form can be of little value.

Thus I think the grounds upon which we class cyanogen in this manner do not, when carefully examined, prove at all sound, but it rather appears, if admission to the group of halogens is given to cyanogen, that we must upon principle further admit within it substances, such as sulphur and oxygen, which obviously should not enter there.

But, outside anything yet stated, it is indisputable that the heavy metallic cyanides do not correspond in general with the chlorides, bromides, &c., of this series of metals; except in the case of the silver salts, there is no appearance even of harmony in this direction.

Again, the most stable oxygen compound of cyanogen is, according to the new chemical notation, CyO, while that of chlorine is Cl_2O_5, of bromine Br_2O_5, &c. Further, CyO (cyanic acid) forms compounds with the metals which are generally insoluble in water, alcohol, or ether; while chloric acid, its alleged analogue, generally forms compounds with them, possessing considerable solubility in these liquids. There is, in fact, as great a difference between the two acids and their metallic compounds on these points as there is between carbonic and nitric acid and between their respective metallic compounds. Further, the composition of platino-chloride of potassium is $K+Pt+Cl_3$, while that of the platino-cyanide is $K_4+Pt_2+Cy_{10}$, exhibiting again a marked difference.

The great dissimilarity existing between cyanogen and the elements of the chlorine group, analogically considered, being thus shown, and the ground I hope consequently ready for the reception of a better classification than the one attacked, I now proceed to show what I conceive to be the proper position of cyanogen in regard to the elements. For this purpose I will refer you to the supposed points of resemblance between this substance and chlorine, which I have just criticised, and I think you will find that, wherever the true character of cyanogen is correctly stated, it agrees precisely with that of oxygen.

Thus, to recapitulate a little, oxygen, especially when in the allotropic form, combines directly with metals generally, including gold and silver; moreover, it combines with hydrogen to form a neutral compound, and this, when electrolysed, delivers its oxygen at the positive pole. Besides this, cyanogen resembles oxygen, wherein, as shown, it differs from the chlorine group, its compound with the alkaline metals being caustic, and those with the heavy metals characterised by great insolubility in water, while several of these cyanides are soluble in alkaline cyanides, precisely as several of the metallic oxides are soluble in alkaline oxides; further, cyanogen, like oxygen, is capable of assuming an allotropic condition.

Following up analogies here, I would class cyanogen and sulphur together, and so I would their hydrides. HS, like cyanogen, is not strongly acid, indeed probably not acid at all, for, as in the case of hydrocyanic acid, HS exhibits a great tendency to oxidise when in contact with water and to form oxyacids, so that in testing this gas for acidity we are liable to obtain reactions not due to the gas itself.

Our new nomenclature, by doubling the equivalents of oxygen and sulphur, has disturbed the uniformity which before this existed between their common hydrides and that of cyanogen; thus one point of resemblance has been removed, but I think this has been done somewhat arbitrarily in regard to cyanogen. Certainly, when the equivalent of cyanogen is retained, its hydride then being CyH (hydrocyanic acid), comparing with that of chlorine, the supposed similarity of these substances is maintained; and this, by the way, may have been one of the reasons for which the doubling process described was broken off at cyanogen. However, if I am correct in assuming that this compound is analogous with oxygen rather than with chlorine, its equivalent will also require doubling. If you now agree with me, or at least will contemplate the possibility, that cyanogen is not analogous to chlorine and its isomorphs, but rather to oxygen, you will be in a position to perceive certain interesting relations which it bears to oxygen, and which could not well have presented themselves had the assumption I have here attempted to disprove remained unassailed.

Thus ferro- and ferri-cyanogen become, upon this view, ferri-oxides in which oxygen is replaced by its isomer, cyanogen, and the same being true for the rest of the metallic cyanides, these substances should be, I think, viewed as comparing with the oxides of sulphur and chromium as they exist in the sulphates or chromates; further, sulpho-cyanogen and seleno-cyanogen, the only compounds containing cyanogen (or at least its elements), which do compare with the simple halogens, are not at all analogous with cyanogen. The cyanides thus viewed are not salts at all any more than the oxides are: sulpho-cyanides, on the other hand, are true salts, comparing exactly with the corresponding salts of the halogens.

Further, in regard to the question often raised as to the nature of certain of our elements, whether compound or not, it seems interesting that in this compound (cyanogen) we have a substance very similar to the element oxygen, one which at least only varies from it within the limits we are compelled to allow for *variation* in the members of certain well defined natural groups of our elements. We are thus, as far as is allowable from such apparent resemblances, justified in entertaining the supposition that oxygen itself is also a compound body. I need not remind you in this connection that any theory which touches upon the nature of this gas has now an especial interest to us, for, as you will be aware, this and our most common gases or gaseous vapours are, for good reasons, considered to be

distributed throughout the earths and suns generally,* and even to pervade the spaces between them, and to perform all the functions we have hitherto allotted to a purely hypothetical substance. The nature, therefore, of any gas which is possibly a constituent of that which we now consider to be a universal atmosphere becomes invested with an importance to us far beyond what we could even conceive of a short time since.

Lastly, in regard to the question as to the nature of our elements, it appears a very noteworthy circumstance that, by combining cyanogen with sulphur, which is also an analogue of oxygen, we obtain a compound analogous to the halogens I have referred to. That this ternary compound, sulpho-cyanogen, should be thus a true salt radical is strongly favourable to the idea that one or more of the chlorine group of elements is of a compound nature, and in relation to this it is worthy of record that, as I have already pointed out, the "equivalent number of sulpho-cyanogen is one which is very nearly the mean between that of chlorine and bromine."

However, whether these facts indicate anything of this kind or not, I think the object of this paper has been fulfilled, for I believe I have shown that, to use a familiar but significant phrase, cyanogen has not the "stuff" in it for making a salt radical singlehanded, therefore it is not in any way analogous to one, but in order to make it so we must combine it with another element, so that three elements in place of two are as yet the smallest number required to form a compound salt radical.

In concluding my paper I cannot avoid expressing a wish that the question which I have raised here had been taken up by some one more accustomed, by training and association, than myself to grapple it by the aid of what is well termed the "New Chemistry." I have worked at this question by the old lights, but if by this I am successful in inducing anyone to take it up who will work at it by the new ones I shall be satisfied with the result.

PHOTOGRAPHY AS APPLIED TO ECLIPSE OBSERVATIONS.†

By ALFRED BROTHERS, F.R.A.S.

SINCE 1860, when photography was first applied to eclipse observations, almost every eclipse of the sun has been photographically recorded—from 1860 to 1868 for the purpose chiefly of determining the nature of the red prominences; and in 1870 and 1871 to ascertain whether the corona is an appendage of the sun or an effect produced in our own atmosphere. Previous to 1870 the ordinary telescope, uncorrected for the chemical rays, had been almost exclusively used. But in 1870 it was determined to adopt a properly corrected photographic lens, and by a graduated series of exposures to obtain, if possible, the whole pictorial effect. This method was successful, and has been adopted in all eclipse work since. That more suitable apparatus has not been employed may be due to the fact that the funds provided by the Government, the Royal and Royal Astronomical Societies, for the observation of the various eclipses have either all been spent at the time, or the balances have been returned. As good work has been done with the apparatus referred to, it may be asked why anything different should be used. It was by mere accident that a lens of a certain kind was used in 1870, no other suitable was to be had, and the image obtained with it is small. Photography was not employed during the eclipse of 1874, almost the only observer on that occasion being the Astronomer Royal at the Cape of Good Hope, Mr. Stone, who observed with the spectroscope under the most favourable conditions, and it is much to be regretted that no photographs were obtained. On the occasion of the recent eclipse no preparations were made until the invitation from the King of Siam was received, and then, as on almost every occasion since 1868, all arrangements have been hurriedly made. No apparatus for obtaining a picture of the corona different from what has been previously used was employed, and consequently no superior result may be anticipated. The lenses used in 1870 and since for photographing the corona give an image of the sun of about three-tenths of an inch in diameter, and although suitable for small pictures, such lenses cannot be said to be the best for the purpose. I would suggest, therefore, that at least three achromatic lenses of 5 or 6 feet focal length, corrected for the actinic rays, should be constructed, with all suitable apparatus, so as to be ready for use when required. The light of the corona is sufficiently actinic to produce good pictures when an instrument of long focus is used—it is only a question of time in the exposure and accuracy in the adjustment of the driving clock apparatus attached to the equatorial mounting. There cannot, I think, be any doubt that under favourable atmospheric conditions some features of interest would be revealed during every eclipse, and it is undesirable to allow any eclipse of the sun to occur without some attempt being made to record such phenomena permanently by means of photography. It seems to me also equally certain that pictures of greater dimensions, such as the instrument suggested would give, would be proportionally more valuable than any hitherto obtained.

The photographic process used has always been the wet collodion. It might be advantageous to use daguerreotype plates, but I see no reason why both methods should not be employed.

* "Fuel of the Sun," by W. Mattieu Williams, F.C.S.

† Read before the Physical and Mathematical Section of the Manchester Literary and Philosophical Society.

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 132.)

THE author in his treatise gives a calculation which verifies these statements. In the above-mentioned experiment with the hand machine 1 kilo. of charcoal yielded 3½ kilos. of ice. Vaass and Littmann give estimates of the first cost of the various machines, and of the price of the ice produced, which varies according to the size of the apparatus, producing respectively from ½ to 10 cwts. hourly, from 1 mark 15 pfennige to 30 pfennige per cwt., including interest on capital, depreciation, and waste. The Nordhausen Company give a calculation for a 250 kilos. machine based on 300 days uninterrupted work (day and night), according to which the ice costs 36 pfennige per cwt. Up to the end of the year 1873 the latter establishment had finished 60 machines, 29 of them for Germany. Vaass and Littmann had completed 42 machines, 20 of which were for Germany, including 2 for Vienna.

At the London Exhibition of 1862, and that of Paris, 1867, Carré's machines were exhibited by Mignon and Rouart, of Paris; at the Vienna Exhibition the two German firms made their appearance.

Carré's machine is without doubt a very perfect, manageable, and effective apparatus for producing ice everywhere and to any extent. In many cases it may successfully compete with the natural article, especially in large towns where the demand is great, and where luxury plays an important part. Artificial ice is often more palatable, since natural ice is too frequently dirty, and even when perfectly clean possesses a swampy flavour. Among the ice manufactories whose existence we have

* "Berichte uber die Entwickelung der Chemischen Industrie Wahrend des Letzten Jahrzehends."

ascertained may be mentioned that of A. Pokorny, in Vienna, which was supplied by Kropff, in 1869, with a machine yielding 5 cwts. hourly. The proprietor has courteously informed the author that he is perfectly satisfied with the working of the machine. It yields 10 cwts. ice per 1 cwt. of charcoal consumed. The cost of the ice amounts to 35 Austrian kreutzers per cwt., the sale price fluctuating from 70 kreutzers to 3 florins 20 kreutzers. The loss of ammonia amounts to 2 kilos. per 50 cwts. of ice produced. The machine has remained in good order for four years, but the connections are not perfect. Ice machines have been set up in various German breweries, to which the makers refer in their circulars. Mignon and Rouart are said to have made in 1869 a machine of the value of 20,000 florins (?) for the Joint Stock Brewery, at Deux-ponts.*

Carré's machine has been from its very origin a very carefully constructed apparatus in which essential improvements are scarcely conceivable. The difficulty as regards the material was soon overcome by making all the parts of wrought-iron coated with zinc, copper, and its alloys being entirely avoided, as they are rapidly attacked by ammonia. Reece, however, in 1870, patented in England an improvement with the object of preventing the simultaneous evaporation of the water in the boiler. He asserts that the liquid which arrives in the ice generator consists of 25 per cent of water and 75 of ammonia. His arrangement, which corresponds in the main with dephlegmation and rectification as customary in distilling, is said to condense the ammonia practically free from water.† He also utilises the tension of the evaporating ammonia in a machine which works the pumps.

In September, 1867, Toselli, of Paris, obtained an English patent (in the name of Clark) for an ammonia ice machine arranged on the principle of Carré's portable apparatus. It consists of two cylinders, united axially by means of a tube, and turned continually by a handle. The ammonia contained in one of the cylinders gave off, when heated, its ammoniacal gas into the other cylinder; the residual water afterwards re-absorbed the gas, the apparatus remaining all along hermetically closed. It was planned both for domestic use on the small scale and for manufacturing purposes. As regards its performance nothing has transpired.

Ammonia Air Pump Machine.—In 1869, Mort and Nicolle, of Sydney, patented an ammonia machine‡ differently arranged from that of Carrè's and capable of being regarded as a combination of the latter with the ether machine. The inventors use an air pump, but assist its action by absorption. As cooling agent they apply not volatilised ammonia, but concentrated aqueous ammonia.

(To be continued.)

ON ISOMERIC ROSANILINES.

By M. A. ROSENSTIEHL.

In 1868, after the discovery of pseudo-toluydins, I showed that commercial magenta does not result from the concourse of two alkaloids only—aniline and toluydin—as was then admitted, but that to these bodies must be added pseudo-toluydin, as one of the most important factors in the production of this remarkable red colouring matter. I indicated at the same time the existence of two isomeric bodies obtained, the one from aniline and toluydin, the other from aniline and pseudo-toluydin, whose physical properties are so nearly allied that they cannot be distinguished. This delicate isomerism—which depends principally on the nature of the generating bodies—ha appeared to me important enough to be confirmed by a great number of experiments. In this work of revision I had in view especially (after having prepared isomeric rosanilines with materials as pure as the actual state of the question permits it to be done) to regenerate the alkaloids in sufficient quantity to be able to determine the relative proportions. This manner of procedure has appeared to me so much the more necessary as experience has shown me in these last years the impossibility of preparing aniline free from pseudo-toluydin. I conclude that it is impossible to separate the three alkaloids so as to obtain each in a state of absolute purity, and I admit that each of them, although prepared with great care, contains the two others in small quantities. I ought, then, to find pseudo-toluydin in alkaloids regenerated from rosaniline prepared with aniline and toluydin: inversely, I ought to find this last in rosaniline prepared with aniline and pseudo-toluydin. It is fit, moreover, to determine the importance of this cause of errors and its influence on the final result.

I prepared rosanilines corresponding to the following mixtures:—

Rosaniline α. Crystallised toluydin. Aniline.	*Rosaniline β 2.* Pseudo-toluydin. Aniline.
Rosaniline β 1. Pseudo-toluydin alone.	*Rosaniline α, β 1.* Crystallised toluydin. Pseudo-toluydin.
Rosaniline α, β 2. Crystallised toluydin. Pseudo-toluydin. Aniline.	

After having obtained in a state of purity the rosanilines corresponding to each of these mixtures, and having compared their physical properties, I treated them with hydriodic acid under pressure, to regenerate the alkaloids. It would be too tedious to describe here the method of separation applied to the mixture of regenerated alkaloids. To show, however, the confidence that it merits I will cite an example. I made with pure alkaloids a typical mixture, I then separated it into its elements:—

	Composition of the Mixture. Grain.	Found on Analysis. Grain.
Aniline	0·376	0·375
Pseudo-toluydin	0·532	0·534
Toluydin	0·040	0·039

I treated with hydriodic acid, besides the isomeric rosanilines, some secondary products of their preparation. These are, first, the products that remain in the mother-liquors of the crystallisation of rosaniline β; second, the insoluble products that are formed at the same time. The results are summarised in the table. (See next page).

From these analytical results we may draw the following conclusions:—

Each rosaniline regenerates in reality three alkaloids, but in a proportion such that there can be no doubt on the isomerism.

The ratio of 1 molecule of aniline to 2 molecules of toluydin demanded by the formula of rosaniline, as established by M. Hofmann, is found pretty nearly in the regenerated alkaloids; however, the aniline is in rather smaller proportions, because it is partly transformed into ammonia by the action of hydriodic acid.

Pseudo-toluydin is in itself alone capable of producing a rosaniline, because by the destruction of CH_2 it is partly transformed into aniline.

There exists three isomeric rosanilines—the first derived from 1 molecule of aniline and 2 molecules of toluydin; the second derived from 1 molecule of aniline and 2 molecules of pseudo-toluydin; the third is formed from 1 molecule of aniline, 1 of toluydin, and 1 of pseudo-toluydin. This latter constitutes the bulk of the magentas of commerce.—*Comptes Rendus.*

* *Dingl. Pol. Journ.*, cxciii., 432.
† Reece, *Dingl. Pol. Journ.*, 1870, 40. See also CHEMICAL NEWS, vol. xxxiii., p. 130.
‡ Mort and Nicolle, *Mech. Mag*, 1870, 189. *Dingl. Pol. Journ.*, cxcvii., 311.

		Rosanilines.					
	α	β 1.	β 1. Mother-Liquor.	β 1. Residue.	β 2.	β 2. Mother Liquor.	β 2. Residue.	α β.
Aniline	25	24	30	32	32	34	50	28
Toluydin (crystalline)	75	3	traces	0	4	2	2	38
Pseudo-toluydin	traces	73	70	68	64	64	48	34

ON CERTAIN CIRCUMSTANCES WHICH AFFECT THE PURITY OF WATER SUPPLIED FOR DOMESTIC PURPOSES.

By M. M. PATTISON MUIR, F.R.S.E.,
Assistant Lecturer on Chemistry, Owens College.

(Continued from p. 126.)

II. *Action on Copper.*—The experiments under this heading were carried out in a manner similar to that already described. The pieces of copper foil presented a surface of 420 sq. m.m. to the action of the various solutions. The results obtained were with one exception negative; no copper was dissolved. The action of the following liquids was examined:—*Distilled water*; the same containing *ammonium nitrate* in quantities varying from 0·02 grm. per litre (= 1·4 grs. per gallon) to 0·408 grm. per litre (= 28·56 grs. ger gallon); the same containing *potassium nitrate* in like amounts; the same containing *ammonium sulphate* in quantities varying from 0·10 to 0·20 grm. per litre (= 7 to 14 grs. per gallon); and also distilled water containing simultaneously *carbonates and nitrates, carbonates and sulphates*, and *chlorides and nitrates*. The length of time during which the copper was exposed to the action of these solutions varied from 18 to 150 hours. The only liquid which exercised *any* solvent action upon the copper was that containing the large quantity of 28·56 *grs. per gallon of ammonium nitrate*; this action was manifested only after 150 *hours'* contact of the liquid with the copper, the amount of metal which had then passed into solution being equal to 3 *milligrms. per litre*, or 0·21 *gr. per gallon*.

The general conclusion to be drawn from these experiments therefore undoubtedly is, that at ordinary temperature neither distilled water nor water containing the salts which commonly occur in drinking waters exercises a solvent action upon copper.

That water charged with carbon dioxide will dissolve copper is apparent from the following figures, which represent the amounts of that metal found by Dr. Milne in various samples of aërated beverages.

TABLE E.

Copper Found in Various Aërated Beverages.

Description of Liquid.	Quantity of Copper in grs. per gallon.
Soda water	0·084
Potash water	0·098
Lemonade	0·053
Ginger ale	0·053
Potash water	0·100
Aërated water	0·089
Soda water	0·100
Aërated water	0·084
Soda water	0·036

In order to arrive at some accurate measurements of this solvent action of water containing carbon dioxide upon copper, I prepared a number of solutions charged with that gas at the ordinary atmospheric pressure, and placed in each a piece of clean copper foil exposing a surface of 2100 sq. m.m. The amount of copper dissolved was estimated by adding sulphuretted hydrogen and comparing the depth of colour produced with that in a standard liquid; the process is exceedingly accurate and delicate. (Table F.)

The general conclusions which I would draw from these results are:—

(1) Distilled water, charged with carbon dioxide, exercises a notable solvent action upon copper, the amount of metal dissolved increasing with the length of time during which it is exposed to the action of the water.

(2) The salts which have the greatest effect in increasing

TABLE F.

Copper Dissolved by Water Charged with Carbon Dioxide at Ordinary Pressure.

Salt.	Mgrms. per litre.	Grains per gall.	Copper Dissolved. In Mgms. per Litre. 24 hrs.	48 hrs.	72 hrs.	120 hrs.	In Grains per Gallon. 24 hrs.	48 hrs.	72 hrs.	120 hrs
Potassium carbonate	200	14·0	0·1	—	0·15	0·20	0·007	—	0·0105	0·014
Calcium chloride	200	14·0	0·7	—	1·20	1·80	0·049	—	0·0840	0·126
Ammonium nitrate	20	1·4	0·3	—	0·60	1·40	0·021	—	0·0420	0·098
"	40	2·8	0·6	—	0·80	1·40	0·042	—	0·0560	0·098
Potassium carbonate and Ammonium nitrate	100 and 20	7·0 and 1·4	0·2	—	0·30	1·00	0·014	—	0·0210	0·070
Potassium carbonate and Ammonium nitrate	200 and 40	14·0 and 2·8	trace	—	trace	0·10	trace	—	trace	0·007
Ammonium nitrate and Calcium chloride	20 and 200	1·4 and 14·0	0·6	—	2·40	3·60	0·042	—	0·1680	0·252
Distilled water	—	—	0·1	0·3	—	1·00	0·007	0·021	—	0·070

TABLE G.

Copper Dissolved by Water Charged with Carbon Dioxide at a Pressure of about 6 Atmospheres.

Salt.	Mgms. per litre.	Grains per gall.	Copper Dissolved. In Mgms. per Litre. 24 hours.	48 hours.	In Grains per Gallon. 24 hours.	48 hours.
Potassium carbonate	40	2·80	1·0	1·2	0·700	0·084
Ammonium nitrate	16	1·12	—	0·8	—	0·056
"	80	5·60	1·2	1·4	0·084	0·098
Distilled water	—	—	0·4	0·6	0·028	0·042

this action are *chlorides* and *nitrates*, especially the latter: if they are *both* present the action is very largely accelerated.

(3) *Carbonates*, especially when present in large quantities, very materially diminish this solvent action.

(4) If *carbonates and nitrates* are *present together* the solvent action of the latter is much diminished by the presence of the former salts, so much so indeed that if the carbonates be present in proportionately large quantities the solvent action upon the copper almost entirely disappears.

I have also carried out a few experiments with the view of determining the amounts of copper which are dissolved by water charged with carbon dioxide under a pressure of several atmospheres; the results are subjoined. (Table G.)

The apparatus were the same as that employed in the experiments with lead.

Surface of copper exposed = 2100 sq. m.m.

Distilled water, charged with carbon dioxide, under a pressure of (approximately) 6 atmospheres, dissolves about three times as much copper as the same water charged at the ordinary atmospheric pressure. Nitrates increase this action and carbonates diminish it.

(To be continued.)

DR. LETHEBY.

At the comparatively early age of sixty died, on the 30th ult., Dr. Henry Letheby, who for many years had been eminent in his profession, who had justly gained an extensive popularity, and whose advice was eagerly sought after, and greatly valued by those who required the assistance of a chemical expert.

As a technological chemist Dr. Letheby was second to none; and in whatever capacity he was acting—whether as Lecturer on Chemistry, Toxicology, and Technology; as Gas and Water Examiner; as Medical Officer of Health; or as Analytical and Consulting Chemist—he always gave evidence of having industriously mastered the minutest details of his subject. His complete knowledge of Chemistry and Toxicology, and his intimate acquaintance with the Sciences of Comparative Anatomy and Physiology, rendered his opinion on subjects connected with medical jurisprudence of especial value.

His writings and labours are so varied and numerous that we cannot refer to them all. To show, however, that we have not unduly magnified his high qualities, and also that in his death Chemical Science has sustained a great loss, we may refer to his admirable Lectures on "Food" delivered before the Society of Arts, and afterwards, at our request, revised and published in book form; to his Lectures on "Practical Toxicology;" to his papers on the "Mode of Conducting Post-mortem Examinations in Cases of Suspected Murder;" to his reports "On the Sanitary Condition of the City of London;" on the "Practice of Disinfection and the Right Use of Disinfectants;" on the "Utilisation of the Waste Products in the Manufacture of Coal Gas;" on "Noxious and Offensive Trades and Manufactures;" on the "Detection of and Tests for Aniline;" &c.

THE RESEARCH FUND OF THE CHEMICAL SOCIETY.

The importance of original chemical research is universally acknowledged. No other branch of Science offers such a wide field for investigation, yet we fear we are not going far from the truth when we state that no other branch of Science has at the present time fewer investigators. In looking through the Proceedings of the Royal or of the Chemical Societies during the last few years, one is struck with the great decrease in the number of papers contributed by our leading chemists, while in other sciences many of the most eminent professors in our Colleges and Universities are continually making valuable additions to our stores of knowledge.

We are, then, especially glad to find that a small additional effort will place the Chemical Society in a position to aid experimental research by grants of money. The limited resources of the Society have hitherto restricted the number and amount of these grants within very narrow limits. In 1872 Mr. T. Hyde Hills placed at the disposal of the Society the sum of £10, as the nucleus of a fund for promoting original research; and offered under certain conditions, made with the object of securing the co-operation of others, to contribute a like sum annually. This attempt of Mr. Hills to form a research fund was not, at the time, seconded. The Council have, however, recently received from Dr. G. D. Longstaff, one of the original members, the generous offer to place at the disposal of the Society the sum of £1000, towards establishing a permanent fund for promoting the advancement of Chemical Science, on the condition that not less than an equal amount be subscribed for the same purpose. Dr. Russell tells us that £640 are already promised, in sums varying from £100 to £1. Those who know the value of original research will, we trust, contribute to the fund, so that the required balance may be speedily raised. By securing to the Society the benefit of Dr. Longstaff's generous offer, contributors are forwarding the interests of Chemical Science, and they are, at the same time, we consider, advancing great national interests.

Subscriptions may be forwarded to Dr. Russell, F.R.S., Treasurer of the Chemical Society, Burlington House.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Anniversary Meeting, Thursday, March 30th, 1876.

Professor ABEL, F.R.S., President, in the Chair.

The President said he had to congratulate the Fellows on the flourishing state of their Society, the number of admissions during the past year having been 103, whilst the losses by death and other causes had been 23, so that the Society now numbered 881 members. He then read obituary notices of the eight Fellows deceased, namely, Thomas Jennings, Henry Letheby, Edward Meldrum, J. Middleton, S. W. Moore, General J. W. Reynolds, Dr. Robert Schenck, and William Smith. The distinguished foreign members we had lost during the past year were Dr. Schrœtter, and Professors Hlasiwetz and Kopp. Before reading the list of papers sent in during the past year—the largest number since the foundation of the Society—he said he must congratulate them on the great improvements in the illumination of their rooms, the result of careful experiments made by their Secretary, Mr. W. H. Perkin, who had most generously defrayed the considerable outlay incurred in making the requisite alterations. After alluding to the Faraday lecture, and the one by Dr. Frankland "On some Points in the Analysis of Potable Water," he said the thanks of the Society were due to Prof. Frankland for the present of a Sprengel pump, to Dr. Longstaff for a balance, and also to Mr. James Duncan for a most valuable and life-like bust of Dr. Hofmann. He then passed to a consideration of the state of the Society's Journal, which, notwithstanding its present size, would require to be considerably increased in the matter of abstracts, in order to keep pace with the large number of papers now published in foreign journals, —and this of necessity requires an increased expenditure.

As the income at present at the disposal of the Society is insufficient to meet this, it was proposed to discontinue the gratuitous distribution of the Royal Society's Proceedings to the Fellows, and also to increase the admission fee for Fellows from two to four pounds. In conclusion, the President mentioned that they had had a legacy left them by the late Mr. Henry Dircks, and that Dr. Longstaff had munificently placed at the disposal of the Society the sum of £1000, provided an equal amount should be raised by subscription, towards establishing a permanent fund for promoting the advancement of the science. He was happy to say that already more than half the amount had been subscribed. After making some reference to Mr. Jodrell's gift to the Royal Society, for promoting original research, and the possibility of adequate State aid being provided for the same purpose, the President concluded amidst great applause.

The Treasurer then read his Report, after which the Fellows proceeded to elect the Officers and Council for the ensuing year, Messrs. C. E. Groves and W. E. Heathfield acting as Scrutators. The following gentlemen were elected :—

President—F. A. Abel, F.R.S.

Vice-Presidents who have filled the Office of President—Sir B. C. Brodie, F.R.S.; Warren De la Rue, D.C.L., F.R.S.; E. Frankland, D.C.L., F.R.S.; A. W. Hofmann, D.C.L., F.R.S.; W. Odling, M.B., F.R.S.; Lyon Playfair, Ph.D., C.B., F.R.S; A. W. Williamson, Ph.D., F.R.S.

Vice-Presidents—T. Andrews, M.D., F.R.S.; W. Crookes, F.R.S.; J. H. Gilbert, Ph.D., F.R.S.; J. H. Gladstone, Ph.D., F.R.S.; G. D. Longstaff, M.D.; J. Stenhouse, Ph.D., F.R.S.

Secretaries—W. H. Perkin, F.R.S.; H. E. Armstrong, Ph.D.

Foreign Secretary—H. Müller, Ph.D., F.R.S..

Treasurer—W. J. Russell, Ph.D., F.R.S.

Other Members of the Council—J. Attfield, Ph.D.; Dugald Campbell; A. H. Church; J. Dewar, F.R.S.E.; F. Field, F.R.S.; C. W. Heaton; David Howard; Nevil Story Maskelyne, F.R.S.; J. A. Phillips, R. V. Tuson; W. Valentin; C. R. A. Wright, D.Sc.

A vote of thanks to the President, proposed by Prof. Williamson and seconded by Prof. Odling, was carried by acclamation, as was also one to the Officers and Council, proposed by Mr. T. Hyde Hills and seconded by Mr. J. Newlands. There was also a vote of thanks to Mr. Henry Watts, the accomplished Editor of the Society's Journal, and to the Abstractors, proposed by Mr. E. C. Nicholson and seconded by Mr. J. Newlands.

Mr. Friswell said he would like to ask the President whether there was any bye-law which would give the Council some control over the use which Fellows might make of the privilege of membership, and then proceeded to detail three or four flagrant instances in which the letters F.C.S. had been used for purposes of advertisement.

Mr. Kingzett then spoke on the same subject, citing other cases, after which—

Prof. Williamson said it occurred to him to make a suggestion which might be practicable, which was to make the newly-elected Fellow sign some declaration to the effect that he would not make any improper use of his membership. If he did break the contract, it would then be expedient to expel him from the Society.

Dr. Russell having read the present obligation from the obligation-book,

The President said that as it at present stood it was somewhat vague and indefinite, but that the subject had already been under the notice of the Council, and would receive their careful attention. He then declared the meeting to be a Special General Meeting for considering an alteration in the Bye-law relating to the admission of Fellows. After a short discussion it was decided that the admission fee should be raised from two to four pounds, the annual subscription remaining the same as at present.

The next ordinary meeting will be on Thursday, April 7.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, February 22nd, 1876.

Edward Schunck, Ph.D., F.R.S. &c., President, in the Chair.

"*Notes on a Collection of Apparatus employed by Dr. Dalton in his Researches, which is about to be exhibited (by the Council of the Literary and Philosophical Society of Manchester) at the Loan Exhibition of Scientific Apparatus at South Kensington*," by Prof. Roscoe, F.R.S.

The apparatus employed by John Dalton in his classical researches, whether physical or chemical, was of the simplest, and even of the rudest, character. Most of it was made with his own hands, and that which is to be exhibited has been chosen as illustrating this fact, and as indicating the genius which with so insignificant and incomplete an experimental equipment was able to produce such great results. The Society has in its possession a large quantity of apparatus used by Dalton, most of which, however, consists of electrical apparatus, models of mechanical powers, models of steam-engines, air-pumps, a Gregorian telescope, and other apparatus of a similar kind, which was either bought or presented to him. It has not been thought necessary to exhibit these, but rather to show the home-made apparatus with which Dalton obtained his most remarkable results.

I. *Meteorological and Physical Apparatus made and used by Dr. Dalton.*

Throughout his life Dalton devoted much time and attention to the study of meteorology; indeed his first work, published in 1793, was entitled "Meteorological Observations and Essays," and his last paper, printed in 1842* (*Mem. Lit. and Phil. Soc.*, vi., 617), consists of auroral observations. Hence the first of Dalton's apparatus which claims attention are the meteorological instruments.

No. 1 is Dalton's mountain barometer, with accompanying thermometer, made for him by the late Mr. Lawrence Buchan, a member of the Society. The barometer is enclosed in a wooden case which Dalton was accustomed to carry in his hand.

Several home-made barometers used by Dalton in his observations are in possession of the Society. They are all of them filled, and the scales prepared, by Dalton himself, and are simple syphon tubes with a bulb blown on at the bottom to serve as a mercury reservoir. These are attached to plain pieces of deal, upon the upper part of which the paper scale is pasted. One of these, which has probably also served for tension experiments (No. 2), has been placed in the collection.

Many of the thermometers appear also to have been home-made. No. 3 is a mercurial thermometer, evidently made and graduated by Dr. Dalton, and marked with his initials, J. D. The freezing-point of this thermometer was tested recently by Mr. Baxendell, who found that it had not altered since the instrument was graduated. Another (No. 4) is of the same kind, and bears the date 1823; No. 5 is a third mercurial thermometer, with long stem and wooden scale; No 6 is an alcohol thermometer, with wooden scale; and No. 7 a registering maximum and minimum thermometer employed by Dalton—maker's name, J. Ronchetti, 29, Balloon Street, Manchester.

II. *Apparatus constructed and used by Dalton in his Researches.*

(1) "On the Constitution of Mixed Gases," (2) "On the Force of Steam or Vapour from Water or Other Liquids, at Different Temperatures, both in a Torricellian Vacuum

* *Vide* "Life of Dalton," by Dr. Henry, published by the Cavendish Society; "Memoir of Dr. Dalton and the History of the Atomic Theory," published in the *Memoirs of the Literary and Philosophical Society of Manchester*, 2nd series, vol. i.; Dr. Lonsdale's "Life of Dalton," Longmans, 1874.

and in Air," (3) "On Evaporation," and (4) "On the Expansion of Gases by Heat." *

No. 8 is an apparatus used for the determination of the tension of volatile liquids at low temperatures: it consists of a syphon tube, at the upper end of which is a scale in inches in Dalton's handwriting. He describes it thus:—"I took a barometer tube 45 inches in length, and, having sealed it hermetically at one end, bent it into a syphon shape, making the legs parallel, the end that was closed being 9 inches long, the other 36 inches. I then conveyed two or three drops of ether to the end of the closed leg, and filled the rest of the tube with mercury, exeept about 10 inches at the open end. This done, I immersed the whole of the short leg containing the ether into a tall glass containing hot water."

No. 9 is a smaller tube, containing another liquid, also having a graduated scale written on paper and attached to the tube. Nos. 10, 11, 12, 13, 14, are tubes used by Dalton for measuring the tension of vapour from water and other liquids at higher temperatures than their boiling-points, both in a vacuum and air. No. 15 is a tube used by Dalton for measuring the tension of the vapour of bisulphide of carbon, labelled "Sulphuret carb.," with a paper scale in Dalton's handwriting, and a cork showing that the upper portion of the tube containing the bisulphide of carbon could be heated in a water-bath to various temperatures. No. 16 is a manometer tube, fixed into a board, divided and numbered by Dalton. No. 17 is an apparatus used by Dalton for the determination of the tension of the vapour of ether, and is interesting as being the instrument by means of which Dalton arrived at one of his most important experimental laws. It is described as follows (p. 564):—"The ether I used boiled in the open air at 102°. I filled a barometer tube with mercury moistened by agitation in ether: after a few minutes a portion of the ether rose to the top of the mercurial column, and the height of the column became stationary. When the whole had acquired the temperature of the room (62°) the mercury stood at 17·00 inches, the barometer being at the same time 29·75 inches. Hence the force of the vapour from ether at 62° is equal to 12·74 of aqueous vapour at 172° temperature, which are 40° from the respective boiling-points of the liquids." This is generally known as Dalton's law of tensions, since shown by Regnault not to be rigorously true.

No. 18 is a wet and dry bulb mercurial thermometer, made by H. H. Watson, of Bolton.

III. *Apparatus for Measuring Gases, and for Determining the Solubility of Gases in Water.*

No. 19 is an apparatus with a graduated tube, probably used by Dalton for the determination of the laws regulating "The Absorption of Gases by Water and Other Liquids," read October 21st, 1803.† No. 20 is a graduated glass tube attached to a bottle of india-rubber, also probably used in his researches on the absorption of gases by water. Nos. 21 and 22 are divided eudiometer tubes, employed by Dalton for measuring the volumes of gases. No. 23 is a spark eudiometer. Nos. 24, 25, and 26 are glass tubes, pipettes, and funnels, graduated by Dr. Dalton and used by him for measuring gases. No. 27 is a graduated glass bell-jar, used for measuring gases. No. 28 is a phial, with graduated tube attached by cement, for collecting and measuring gases. Nos. 29 and 30 are stoppered phials with the bottoms cut off, used as gas jars for collecting and measuring gases. No. 31 is a thousand grains specific gravity bottle, with its counterpoise of lead stamped "175," and paper labelled "Bottle balance." No. 32 is a pipette. No. 33 a square bottle of thin glass, fitted with brass caps, and probably used for the determination of the specific gravities of gases. No. 34 is an earthenware cup, used by Dalton as a mercury-trough, and containing a small phial with mercury. Nos. 35 and 36 are bulb-tubes, with graduated scales, which may have served for the determination of the coefficients of expansion of gases. No. 37 is a Florence flask with cork and valve, for determining the specific gravity of gases. No. 38 is a glass alembic.

IV. *Weights, Balances, Apparatus, Reagents, and Specimens used by Dalton.*

No. 39, eleven phials, containing creosote, iodine, amalgam of bismuth and mercury, quercitron bark, gnaa sylvestra cochineal, and other substances, labelled in Dalton's handwriting. No. 40, three divided blocks, used by Dalton for the illustration of his lectures: these are not, however, the balls an inch in diameter (referred to in his latest memoir on the "Analysis of Sugar") which he employed occasionally in his lectures, as illustrating his newly-discovered laws of combination and the atomic theory; these appear, unfortunately, to be no longer in existence. No. 41 is a common pair of scales used by Dalton, No. 42 a pair of apothecary's scales and weights employed by Dalton, with a paper of weights made of wire, labelled in his handwriting, "100th grains." No. 43 is a box of weights used by Dalton, and containing a pill-box labelled "Platina," another pill-box labelled "Hund," and containing 100th of grains, and another wooden box containing brass gramme weights, labelled "Weights, French:" the other ordinary weights are of lead. No. 44 is Dalton's pocket-balance, consisting of a small pair of apothecaries' scales, with beam about 4 inches long, and having the pans attached by common string; it is contained in a tin case for the pocket. No. 45 is a penholder used by Dalton. No. 46, leaden grain weights made by Dalton from sheet lead, and stamped in numbers by him; No. 47, iron punches used by Dalton for this purpose. No. 48, a glass lens, wrapped in a piece of paper labelled, in Dalton's writing, "Sun's focus 4·2 inches." No. 49 is a paper containing "10th of grains," made by Dr. Dalton of iron wire. The paper in which these are wrapped is part of a note from one of Dr. Dalton's pupils (as is well known he lived by teaching mathematics at half-a-crown per lesson), in which the writer presents his "compliments to Mr. Dalton, and is sorry that he will not be able to wait upon him to-day, as he is going to Liverpool with a few friends who are trying the Railway for the first time. Mr. D. may fully expect him on Monday at the usual time." No. 50 are bottles of tin, earthenware, and silver, some of them being common penny pot ink-bottles. Each has a thermometer tube cemented into the neck of the bottle, and these tubes are provided with paper scales. These were used by Dalton probably for experiments on radiant heat. No. 51 is a manometer tube used by Dalton: it consists of a tin vessel attached on either side to leaden tubing, and having a thermometer-tube closed at the upper end, and provided with a divided scale, fixed into the upper portion of the tin vessel. No. 52, Dalton's balance, made by Accum, and capable of arrangement as hydrostatic balance, with weights and counterpoises.

* Experimental Essays on the above subjects, by John Dalton, read October 2nd, 16th, and 30th, 1801, and published in the 1st series, vol. v., part 2, of the *Memoirs of the Literary and Philosophical Society of Manchester.*

† *Manchester Memoirs*, 2nd series, vol. i.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances, de l'Academie des Sciences. No. 11, March 13 1876.

Silicidation of Platinum and certain other Metals.—M. Boussingault.—The author finds that platinum, palladium, iridium, and ruthenium, if heated to redness in charcoal, do not become carburetted. At very high temperatures silica is reduced by carbon. If platinum is introduced into a mixture of carbon and silica, heated to

whiteness in order to convert it into a silicide, the platinum does not exert an action of presence which determines the reduction of the silica, but merely seizes the silicium as it is set at liberty by the carbon. If silica mixed with charcoal is ignited at a high temperature, free silicon is not found in the mixture after it has been allowed to cool with exclusion of air.

Source of Oxide of Carbon Characteristic of the Formines and the Polyatomic Alcohols.—M. Lorin.—The formic ethers of the monatomic alcohols do not yield carbonic oxide on decomposition, hence the decomposition of the crude formines becomes a new characteristic of the polyatomic alcohols.

Reimann's Farber Zeitung, No. 12, 1876.

This issue contains an article on cochineal and a paper on preparations for rendering textile fabrics uninflammable. The salts recommended for this purpose are the sulphate of ammonia and lime, obtained by mixing sulphate of ammonia with gypsum, and the borate of magnesia, formed by the double decomposition of borax and sulphate of magnesia. The experiments carried out with these salts, at the Geological Institute of Vienna, were very successful.

A letter from Rouen notices the extensive and successful use of the new vanadium aniline-black, both in printing and dyeing. Per litre of dye the proportions preferred are 40 grms. salt of aniline, 20 grms. chlorate of potash, and 0·001 grm. vanadiate of ammonia.

Solution of methyl-violet is best made by adding to 1 part of the broken dye 20 parts of water a little below the boiling-point, pouring in the water slowly and stirring slowly but constantly. The colour thus obtained is gradually diluted by the addition of water, with continual stirring. It must be allowed to cool very slowly, and not be filtered till quite cold.

Bulletin de la Société d'Encouragement pour l'Industrie Nationale, No. 27, March, 1876.

This issue contains no chemical matter.

Les Mondes, Revue Hebdomadaire des Sciences, Nos. 11 and 12, March 16 and 23, 1876.

These issues contain no chemical matter.

MISCELLANEOUS.

The Royal Society.—The President's reception, on Wednesday evening last, was numerously attended, and included a large number of distinguished guests. There were exhibited in the several rooms many objects of interest. The treasurer, Mr. W. Spottiswoode, showed a pair of the largest Nicol prisms yet made; Prof. Tyndall, some infusions exposed to self-cleansed air; Dr. Siemens, his Bathometer, an instrument for indicating the depth of the sea without the use of a sounding-line; also an Attraction Meter, by which the attraction of masses is demonstrated. Mr. H. C. Sorby exhibited a new method of measuring the position of absorption-bands in spectra, and specimens of pigments from human hair; Dr. Schüster, some experiments with the view of showing that the force discovered by Mr. Crookes reacts on the vessel in which the vacuum is; a Photometer, devised by Prof. Osborne Reynolds and Dr. Schüster, for the purpose of measuring the heating effect of light, was also exhibited. Mr. C. J. Woodward showed his new form of Wave-apparatus; while Crookes's Radiometers were exhibited by the manufacturer, Mr. J. J. Hicks. Mr. Crookes exhibited a Torsion Balance and some Experimental Radiometers, illustrating various phenomena connected with the Repulsion resulting from Radiation. A description of the Torsion Balance will be found on page 141. The Experimental Radiometers were as follows:—

1. The Turbine Radiometer. In this Radiometer the vanes are black on both sides, and are inclined at an angle like the sails of a windmill instead of being in a vertical plane. The instrument is not sensitive to horizontal radiation, but moves readily in one or other direction to a candle held above or below.

2. Radiometer with the vanes blacked on both sides, showing rotation in either direction according to the way the light falls on them.

3. Radiometer showing the very small amount of residual air which is present. The vanes of the Radiometer move past a piece of pith suspended by a silk fibre. Rotation with great velocity scarcely causes sufficient motion of the residual air to move the suspended pith.

4. Radiometer showing rotation of the glass envelope when the vanes are held fixed in space. The Radiometer carries a magnet on its arms, and is floated on water so as to be free to move. The vanes are held stationary by an outside magnet. On allowing radiation to fall on the black surfaces of the vanes the glass envelope rotates.

5. Radiometer having inside it a platinum spiral. The Repulsion of the white and black surfaces is equal when the spiral is below redness. Above a red-heat the black is repelled more than the white, and rotation takes place.

6. Radiometer with one vane counterpoised by a mirror, showing method of keeping the steel point from falling off the cup.

7. Radiometer constructed of metal, showing reverse movement on cooling.

8. Bar Photometer, showing the method of balancing one light by another.

9. Heat Engine. A Turbine Radiometer, having ice below and hot air above; working by difference of temperature.

Mr. Apps, Mr. Browning, Messrs. Elliott Bros., Messrs. Tisley and Spiller, and Mr. W. F. Stanley, were also among the exhibitors.

Royal Institution of Great Britain.—The following are the arrangements for Lectures after Easter:—

Prof. P. M. Duncan, F.R.S.—Four Lectures on the Comparative Geology and former Physical Geographies of India, Australia, and South Africa; on Tuesdays, April 25 to May 16.

Prof. Tyndall, D.C.L., LL.D., F.R.S.—Seven Lectures on Voltaic Electricity; on Thursdays, April 27 to June 8.

Prof. W. K. Clifford, F.R.S.—Two Lectures on the Present Relations of Science and Philosophy; on Saturdays, April 29 and May 6.

Prof. W. G. Adams, F.R.S.—Three Lectures on some of Wheatstone's Discoveries and Inventions; on Tuesdays, May 23 to June 6.

Frederick J. Furnivall.—Two Lectures on Chaucer; on Saturdays, May 13 and 20.

J. A. Symonds.—Three Lectures on the Medici in relation to the Renaissance; on Saturday, May 27 to June 10.

The Friday evening meetings will be resumed on April 28th, at 8 p.m. Prof. Gladstone will give a Discourse on Methods of Chemical Decomposition illustrated by Water, 9 p.m. The following Discourses will probably be given by Messrs. G. J. Romanes, W. Froude, C. T. Newton, J. F. Moulton, Sir J. M. Lubbock, and Prof. Tyndall. To these meetings Members and their friends only are admitted.

New Disinfecting Powder.—We have examined an excellent disinfectant sold under the name of "The Universal Disinfecting Powder." It consists of Cooper's salts and sulphate of zinc, and is certainly most effective. We extract the following from a report by Prof. Wanklyn:—"This powder contains 70 per cent of mixed chloride of sodium and chloride of calcium, and about 6 per cent of anhydrous sulphate of zinc (equal to about 12 per cent of hydrated sulphate), a little insoluble matter, and 15 per cent of moisture. I have no doubt that it is an excellent disinfectant. It is, comparatively speaking, non-poisonous and harmless."

TO CORRESPONDENTS.

F. A. Cole.—We should advise you to advertise.
W. M. Paterson.—Asher and Co., of Bedford Street, Covent Garden, will probably supply it.
R. Picard.—Write to the editor of *The Brewers' Journal.*
G. G. Blackwell.—We do not know Dr. Fremy's address.

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Notes on the Composition and Testing of Tin Red Liquors, by Mr. J. H. Jones—On the Recovery of Indigo from Spent Vats, by Mr. G. H. Underwood—Vanadium in Dyeing and Calico Printing—The Manuscript of Jehan le Begue—On the Dip-blue Styles of Calico Prints, by Mr. G. H. Underwood (continued)—Note upon a Method of Preventing the Action of Iron upon Alizarine and Madder Extracts, by M. J. Wagner—Critical and Historical Notes concerning the Production of Adrianople or Turkey Red, and the Theory of this Colour, by Theodore Chéteau (continued)—List of English, Scotch, and Irish Calico Printers in 1840—Abridgment of Complete Specifications of Patents Recently Published—British and Foreign Patents, from the Commissioners of Patents Journal, February 22nd, to March 17th, 1876, inclusive—Supplement: The Practice and Principles of Calico Printing, Bleaching, Dyeing, &c., by Charles O'Neill. Printing (continued).

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PRELIMINARY NOTICE ON THE ACTION OF SULPHURIC ACID ON NAPHTHALENE.

By JOHN STENHOUSE, LL.D., F.R.S., &c., and CHARLES E. GROVES.

FARADAY,* many years ago, observed that when naphthalene was heated with concentrated sulphuric acid, a mixture of two sulphonic acids was formed. These acids yielded baryta salts, which differed from one another in that one of them burned with flame when heated, whilst the other merely smouldered. Merz and Weith, who have carefully examined these acids,† found that when sulphuric acid (400 grms.) was heated with excess of naphthalene (500 grms.), at 160°, for eight hours, the product, besides "*unaltered naphthalene*," consists almost entirely of β-naphthalene sulphonic acid, with traces of the α-sulphonic acid and of the disulphonic acid. On examining what these chemists believed to be "unaltered naphthalene," however, we found that it contained a comparatively large quantity of sulphur compounds insoluble in water, and from which, after a few preliminary trials, we succeeded in isolating three distinct crystalline compounds.

In order to obtain satisfactory results, and to facilitate the subsequent purification of the compounds, it is necessary to employ pure naphthalene. This may be obtained by heating the purest commercial naphthalene, with a small percentage of sulphuric acid, to about 180°, for some hours, and distilling the resulting black mass in a current of steam; repeating the process until the hydrocarbon will dissolve at 100°, in an excess of concentrated sulphuric acid, without the slightest tinge of colour. A mixture of 8 parts of the hydrocarbon with 3 of sulphuric acid are then heated to 180° in a large retort: after the lapse of two or three hours, water begins to come off, and the mercury in the thermometer falls, so that it is necessary to increase the heat in order to maintain the temperature constant. At this stage a reaction appears to set in, which continues for an hour or two, accompanied by the elimination of a considerable quantity of water, which distils over. About an hour after water ceases to come over, the source of heat is withdrawn, and the retort and its contents allowed to cool to 100°: 4 parts of boiling water are then added, and the mixture poured out into a basin or other convenient vessel. On examining the product when cold, it will be found to consist of two layers; the lower one being a dirty greenish, pasty, mass of crystals, of the nearly pure β-sulphonic acid; whilst the upper solid cake, which is of a pale brownish yellow colour, consists of the new sulphur compounds mixed with excess of naphthalene. The solid cake is separated from the crystals of acid, and submitted to distillation in a current of steam in the usual way: the naphthalene then passes off with the aqueous vapour, leaving a brown oily layer at the bottom of the water in the distilling flask, which oil, however, becomes solid on cooling.

Naphthalene Sulphones.—The most convenient way of obtaining the sulphones in the crystalline state from this cake is to powder it and boil it up with carbon bisulphide, filtering hot, and washing the undissolved portion with carbon bisulphide until the washings pass through colourless. The solution, if sufficiently concentrated, when allowed to stand, deposits a considerable quantity of hard, thick, prismatic crystals of *α-naphthalene sulphone*, mixed, however, with nodular masses of needles, from which they may be separated mechanically or by repeated fractional crystallisation from alcohol and from carbon bisulphide. The α-sulphone may very readily be purified by alternate crystallisation from these solvents, and it then melts at 123° C. When submitted to analysis it gave numbers corresponding closely with those required by the formula $C_{20}H_{14}SO_2$. It is colourless and insoluble in water, but moderately soluble in boiling alcohol, from which it crystallises out in great part, on cooling, in opaque nodules and transparent plates. It is also moderately soluble in ether and in hot carbon bisulphide, crystallising from the latter in compact, transparent, oblique prisms. It is easily soluble in hot benzene or glacial acetic acid, but only very slightly soluble in petroleum. Hot concentrated sulphuric acid dissolves it, apparently forming a sulphonic acid, whilst with nitric acid the sulphone yields a readily-fusible nitro-derivative, which may be obtained in a crystalline state from hot alcohol. Although the sulphone is not acted on by potassium dichromate and dilute sulphuric acid, a solution of chromic anhydride in glacial acetic acid readily oxidises it. On adding water to the solution a pale yellow substance is precipitated, which is easily soluble in alcohol.

The portion left undissolved, when the crude substance is treated with carbon bisulphide, consists almost entirely of β-naphthalene sulphone, and may readily be purified by a few crystallisations from alcohol, although it is somewhat difficult to obtain it free from all trace of colour. The tufts of needles which crystallise out of the carbon bisulphide solution, along with the α-sulphone, also consist of β-naphthalene sulphone. When pure it crystallises from boiling alcohol, in which it is but slightly soluble, in colourless silky needles. It melts at 177° C., and the results of the analyses that were made showed it to be isomeric with α-naphthalene sulphone. Like that substance, therefore, it has the formula $C_{20}H_{14}SO_2$. The β-sulphone is insoluble in water, very slightly soluble in petroleum, carbon bisulphide, or cold benzene, although it is tolerably soluble in hot benzene and glacial acetic acid. It dissolves in hot concentrated sulphuric acid, forming a sulphonic acid, and when gently heated with nitric acid, sp. gr. 1·45, it first fuses to an orange-brown oily layer, which then rapidly dissolves in the hot acid. If the solution be now allowed to cool, most of the nitro-derivative is deposited as an oil, which solidifies after a time; but if the hot acid solution is diluted with nitric acid, of sp. gr. 1·35, boiled for a minute or two, and set aside to cool, the new compound is deposited in microscopic crystals. These are only very slightly soluble, either in alcohol, glacial acetic acid, or benzene. It yields an amido-compound when treated with tin and hydrochloric acid. The β-sulphone, like its isomeride, is not attacked by potassium dichromate and dilute sulphuric acid, although chromic anhydride and glacial acetic acid readily oxidise it: the addition of water then precipitates a pale yellow body, easily soluble in alcohol.

It was pointed out by one of us some years ago* that phenyl sulphide, $C_{12}H_{10}S$, when treated with oxidising agents, was readily converted into benzene sulphone, $C_{12}H_{10}SO_2$. It seemed of interest to ascertain whether naphthyl sulphide, $C_{20}H_{14}S$, would behave in a similar manner. For this purpose we used α-naphthyl sulphide, kindly placed at our disposal by Dr. H. E. Armstrong, was treated with potassium dichromate and dilute sulphuric acid: the compound was rapidly oxidised, but the product was resinous, and resisted all our efforts to obtain from it any crystalline compound resembling the sulphones above described.

We hope soon to be able to give further details with regard to the properties and reactions of the various compounds mentioned in this paper, and also to describe the other crystalline substance which accompanies the sulphones, but differs from them in being exceedingly soluble in carbon bisulphide.

* *Phil. Trans.*, 1826, 140.
† *Deut. Chem. Ges. Ber.*, iii., 195, and *Zeits. Chem.*, vi., 169.

* *Proc. Roy. Soc.*, xiv., 384.

ON THE

INTERFERENCE OF CERTAIN METALS WITH THE ACCURACY OF THE PROCESS FOR ESTIMATING COPPER BY CYANIDE OF POTASSIUM.*

By ROBERT T. THOMSON.

I AM well aware that experiments have been made on this subject to a certain extent by other parties, and that it is generally recognised as a fact that zinc, arsenic, and some other metals interfere with the estimation of copper by the cyanide process, while iron, calcium, magnesium, &c., as far as I am aware, are supposed not to have any effect.

I have undertaken the following experiments with the view of ascertaining the precise effect of the more commonly occurring metals under the usual working conditions. The experiments also include a series instituted to determine the effect of different proportions of hydrate, chloride, and nitrate of ammonium.

In the case of the metals the estimation of the copper in each case was made as follows:—

To the solution containing the copper and the other metal (0·2 grm. of each), a quantity of ammonium chloride solution containing 2 grms. of that salt was added, then ammonia till the precipitated hydrate of copper was just beginning to dissolve, and finally 40 c.c. of ammonia (sp. gr. 0·963) which completely dissolved the hydrate of copper and formed a blue solution. This solution was now made up to 150 c.c. with water, and the cyanide solution added from a burette till only the faintest violet tinge was perceptible in the fluid. The solution was well stirred and allowed to stand for a few minutes after each addition of the cyanide, and in cases where precipitates were formed, the latter were allowed to settle before determining whether the fluid was sufficiently free from colour to indicate that enough cyanide solution had been added.

Potassium and Sodium.—These metals, as was expected, have no appreciable effect on the estimation of copper by this process.

Calcium.—When the potassium cyanide was added to the solution containing the copper and this metal, a white precipitate of calcium carbonate was formed. The formation of this precipitate was owing to the presence of a considerable quantity of potassium carbonate in the potassium cyanide used, which is usually the case with the commercial salt. The white precipitate was allowed to settle after each addition of the cyanide before judging from the colour of the fluid whether the operation was finished. In case, however, the precipitate should in any way interfere with the colour of the liquor (as will be seen afterwards seems to be the case with some other metals) the precipitate was filtered off when the operation was considered as finished, but from the colour of the filtered liquid it was evident that the precipitate did not interfere, the same faint violet tinge remaining as when the precipitate was mixed with the fluid.

It will be seen from Table I. that a larger volume of cyanide solution was consumed than when no calcium was present, showing 0·0027 grm. more copper than was really present. As this difference does not seem to be due to an optical effect (as is probably the case with some of the metals which give *coloured* precipitates), it may be fairly presumed that it arises from some chemical action between the potassium cyanide and the calcium salt.

Barium and Strontium.—The same remarks are applicable to these metals, although the interference of each metal is greater than that of calcium.

Magnesium.—There is nothing special to note about this metal, the solution remaining perfectly clear, and its interference being comparatively little.

Zinc.—In the case of this metal the solution remained clear. It interferes with the estimation in a greater degree than any of the metals yet noticed, giving about one-fifth more copper than was actually present.

Cadmium.—This metal also interferes in the same direction as zinc, though not nearly to such an extent as the latter metal.

Aluminium.—In the case of this metal the white gelatinous precipitate of alumina was thrown down by the ammonia used. The amount of copper obtained was considerably too high.

Iron (ous).—An attempt was made to estimate the copper in presence of iron in the ferrous state of combination, but it was unsuccessful owing to the incomplete precipitation of the iron as ferrous hydrate by the ammonia, and the consequent continuous precipitation of oxide of iron from the solution by the action of the air. The precipitation of the oxide of iron went on for hours, keeping the solution so muddy that it was impossible to perceive the blue colour of the fluid. By this time the ferrous hydrate was pretty well converted into ferric hydrate, and though the precipitate now settled and left the fluid clear, it was useless to proceed with the operation, as it would simply be the estimation of copper in presence of iron in the ferric state. This matters the less as it is not necessary to estimate copper in presence of iron in the ferrous state, the conversion from the latter into the ferric condition being very easy.

Iron (ic).—All the iron is precipitated in this case by the ammonia as ferric hydrate, and it is customary and is

TABLE I.

Showing Results Obtained by the Cyanide Process for the Estimation of Copper in Presence of some other Metals.

Amount of copper used, 0·2 grm.
Amount of other metal used, 0·2 grm.
Amount of NH_4Cl used, 2·0 grms.
Amount of NH_4HO (sp. gr. 0·963) in excess used, 40 c.c.
Total volume of each solution before adding the cyanide solution, 150 c.c.
C.c. of cyanide used for copper alone:—36·2—36·3; mean 36·25.

Metal used.	C.c. of Cyanide consumed.	Copper found (apparent)	Error (mean).	Condition of Solution.
Potassium ..	36·1—36·2	0·1991—0·1997	0·0006 L.	Clear
Sodium ..	36·2—36·3	0·1997—0·2003	—	,,
Calcium ..	36·8—36·7	0·2030—0·2024	0·0027 H.	Ppt.
Barium ..	37·1—36·8	0·2046—0·2030	0·0038 H.	,,
Strontium ..	37·1—37·3	0·2046—0·2057	0·0051 H.	,,
Magnesium	36·5—36·7	0·2013—0·2024	0·0018 H.	Clear
Zinc	43·7—43·8	0·2411—0·2416	0·0413 H.	,,
Cadmium ..	38·7—38·8	0·2135—0·2140	0·0137 H.	,,
Aluminium	37·5—37·6	0·2069—0·2074	0·0071 H.	Ppt.
Iron (*ous*) ..	—	—	—	,,
Iron (*ic*) ..	35·9—36·0	0·1980—0·1986	0·0017 L.	,,
Manganese	27·4—27·1	0·1511—0·1495	0·0497 L.	,,
Chromium ..	—	—	—	,,
Cobalt.. ..	—	—	—	Clear
Nickel.. ..	80·0—79·8	0·4413—0·4403	0·2408 H.	,,
Uranium ..	37·0—37·3	0·2041—0·2057	0·0049 H.	,,
Tin (*ous*)	33·0—32·8	0·1820—0·1809	0·0186 L.	Ppt.
Tin (*ic*) ..	36·8—36·7	0·2030—0·2024	0·0027 H.	,,
Molybdenum	36·2—36·2	0·1997—0·1997	0·0003 L.	Clear
Arsenic ..	36·2—36·3	0·1997—0·2003	—	,,
Antimony ..	36·9—37·0	0·2035—0·2041	0·0038 H.	Ppt.
Bismuth ..	37·0—37·3	0·2041—0·2057	0·0049 H.	,,
Lead	36·4—36·4	0·2008—0·2008	0·0008 H.	,,
Mercury(*ous*)	43·3—43·1	0·2388—0·2377	0·0382 H.	Clear
Mercury(*ic*)	44·6—44·8	0·2460—0·2471	0·0465 H.	,,
Thallium ..	36·9—37·1	0·2035—0·2046	0·0040 H.	Ppt.
Silver	47·7—47·8	0·2631—0·2637	0·0634 H.	Clear
Gold	48·1—48·1	0·2653—0·2653	0·0653 H.	,,
Platinum ..	43·2—43·3	0·2383—0·2388	0·0385 H.	Ppt.
Palladium ..	58·8—59·0	0·3244—0·3255	0·1249 H.	Clear

(H., high. L., low.)

* Read before the Chemical Section of the Philosophical Society, Glasgow, December 6, 1875.

considered most accurate to estimate the copper in presence of this precipitate. This is done because of the difficulty of separating the copper by precipitating the ferric hydrate with ammonia, a portion of the copper being retained by the precipitate even though the latter be re-dissolved and re-precipitated.

It will be seen from Table I. that when the ferric hydrate precipitate is retained in the liquor a low result is the consequence. After the operation seemed to be finished, the precipitate was filtered off, but on examining the filtrate the colour was found not to be discharged to the proper extent. The addition of the cyanide solution to the clear fluid was therefore continued till the proper point was reached, and in the first example given in the Table 1·1 c.c., and in the second 1 c.c., more of the cyanide was consumed, making in all 37 c.c. in each experiment. These results show that when the precipitate was retained in the liquor, the error was, as a mean, 0·0017 grm. too *low*, and in the filtrate 0·0041 grm. too *high*. Other experiments made when the ferric hydrate precipitate was not allowed to settle so completely as in the experiments just mentioned, gave considerably lower results than those given in the Table.

The cause of these differences is manifestly of a two-fold character. In the case of the determination of the copper in the presence of the ferric hydrate, the result, as already stated, is too low, and this seems to arise from an optical effect, the colour of the precipitate seeming to neutralise the blue tint of the fluid above it, so that when the clear solution is poured or filtered off, the blue tint still remaining is intense enough to be perceived at once. This view is supported by the fact that when a disc of red paper is placed at the bottom of the filtered fluid, the blue colour of which is very distinct, the colour of the fluid is partly neutralised. The fact that the filtered fluid consumed such an additional amount of cyanide points to the probability that there is some chemical action between the cyanide and the iron compound.

Manganese.—With regard to this metal it will be seen from Table I. that the amount of copper found was about one-fourth too *low*, an effect quite the reverse of that produced by zinc. In this case also, as in that of iron in the ferric state, the presence of the precipitate influences the colour of the solution, making it appear nearly colourless, when really its blue tint is quite apparent on being filtered off. Indeed the filtered liquid consumed in the first example given in the Table 1·2 c.c., and in the second 2·3 c.c., more of the cyanide solution, giving still a mean error of 0·04 grm. too low.

Chromium.—The oxide of chromium was precipitated by the ammonia, and after the addition of a limited quantity (about 24 c.c.) of the cyanide solution, the fluid, after the precipitate had settled, was seen to have a greenish blue colour. The precipitate was now filtered off and more cyanide added, but when from 30 to 35 c.c. had been used, the filtrate assumed a pinkish brown colour. It is obvious, therefore, that it is impossible to decide when the estimation is finished.

Cobalt.—When about 40 c.c. of the cyanide solution were added to the solution, the latter assumed a greenish blue colour, and on further addition the solution became greenish with a brown tinge, but after the addition of about 70 c.c. the green altogether disappeared, and the solution acquired a brownish colour. It is evident that it is impracticable to estimate copper in presence of large quantities of cobalt, owing to the impossibility of determining the point at which the operation is completed, and even though that were possible, a high result would be obtained.

Nickel.—In the case of this metal the solution remained clear during the whole process. The amount of copper brought out, as will be seen in Table I, is more than double the actual quantity present.

Uranium.—When ammonia was added to the solution a precipitate of uranate of ammonium was thrown down, which dissolved on the subsequent addition of the cyanide of potassium. After about 35 c.c. of the cyanide solution had been added the solution became green, but the estimation could not be considered as finished, because this colour was evidently owing to the mixture of the blue copper salt with the yellow uranium salt, and therefore as long as the green colour remained enough cyanide had not been added. The addition of the cyanide solution was now continued, and when 37 c.c. in the one experiment, and 37·3 c.c. in the other, were consumed, the solution assumed a yellow colour.

Tin (ous).—With tin in the stannous condition a white precipitate was formed by the ammonia, which remained insoluble. The copper found was much too low.

Tin (ic).—With tin in the stannic condition a white precipitate was formed by the ammonia, which did not dissolve to any extent sensible to the eye. The amount of copper found was somewhat too high, an effect the reverse of that in the case of the stannous compound.

Molybdenum.—This metal has no appreciable effect.

Arsenic.—This metal, whether present in the form of arsenious or arsenic acid, does not interfere with this process, the mean of the two experiments, as will be seen by reference to Table I., giving exactly the amount of copper present.

Antimony.—In the case of this metal a white precipitate was formed, which remained insoluble. The amount of copper found was considerably too high.

Bismuth.—With this metal the white hydrate of bismuth was precipitated by the ammonia, and it remained insoluble during the whole process. The error was considerable, and on the high side.

Lead.—A white precipitate was also formed with this metal, which did not re-dissolve. The interference was very slight.

Mercury (ous).—On the addition of the ammonium chloride, mercurous chloride was precipitated, which was turned black by the ammonia, and dissolved by the potassium cyanide. About one-fifth more than the actual amount of copper was indicated in this case.

Mercury (ic).—In this case mercuric chloride was used, and when the ammonia was added "white precipitate" was formed, which dissolved completely in the potassium cyanide subsequently added. The error in this case was rather greater than, and in the same direction as, in the preceding case.

Thallium.—This metal, which was used in the form of nitrate, gave a white precipitate of thallous chloride by the addition of the ammonium chloride, but this precipitate was partially dissolved by the ammonia and potassium cyanide subsequently added. The mean of the two experiments shows an error of 0·004 grm. too high.

Silver.—The addition of the ammonium chloride produced a precipitate of chloride of silver which immediately dissolved in the ammonia, and the solution remained clear during the estimation. A result giving 0·0634 grm. of copper too high, which is about one-third of the amount of copper present, was obtained.

Gold.—By the addition of the ammonia the yellow aurate of ammonium was precipitated, but was gradually dissolved by the potassium cyanide. The error is equal to nearly one-third of the copper present (too high).

Platinum.—The ammonium chloride caused the precipitation of the yellow crystalline ammonio-chloride of platinum, but on the addition of the potassium cyanide the greater part of the precipitate dissolved, and only a small quantity of a greenish flocculent precipitate remained insoluble. A mean error of 0·0385 grm. too high was the result. A curious circumstance in connection with the interference of this metal may here be noticed. After the process seemed to be finished the small precipitate was filtered off, and after the filtered solution had stood over night (sixteen or eighteen hours) the solution again assumed a blue colour, and in the first experiment given on Table I., required 1·8 c.c., and in the second 2 c.c. of the cyanide solution to discharge the colour to the proper

extent. This returning of the blue colour is remarkable, because, when copper alone is present, or when it is along with any of the other metals noticed, the tendency is for the faint colour left in the solution, altogether to disappear and leave the solution colourless.

Palladium.—On the addition of the ammonia, the flesh-coloured ammonio-chloride of palladium was precipitated, which did not dissolve to any extent perceptible to the eye, in the excess of ammonia. When the potassium cyanide was added, using a few c.c. at a time, and allowing to stand for a short time after each addition, the precipitate gradually dissolved. In the second experiment the potassium cyanide was added rapidly, and when about 48 c.c. had been added the blue colour of the fluid was completely discharged, but the ammonio-chloride of palladium was not dissolved. After standing for a few minutes, however, the precipitate dissolved and the liquid became blue again, and 11 c.c. more of the potassium cyanide solution were required to complete the estimation. The mean error shown by these experiments is 0·1249 grm. too high, or above one-half more than the real amount of copper present.

The Interference of Ammonia in Various Proportions with the Accuracy of the Process for Estimating Copper by Cyanide of Potassium.

In the experiments made on the interference of ammonia, the same quantities of copper and ammonium chloride were used as with the metals, and the estimation of copper taken as the standard of reference was that obtained when 40 c.c. of ammonia of sp. gr. 0·963 was present, being also the same as that used in the case of the metals. The amount of interference caused by ammonia does not rise in proportion to the quantity used, but as more ammonia is used the additional amount of interference becomes less, as will be seen by reference to Table II.

TABLE II.

Showing Results Obtained by the Cyanide Process for the Estimation of Copper in Presence of Ammonia in Various Proportions.

Amount of copper used, 0·2 grm.
Amount of NH_4Cl used, 2·0 grms.
Total volume of each solution before adding the cyanide solution, 150 c.c.
C.c. of cyanide consumed in presence of 40 c.c. of ammonia (sp. gr. 0·963) :—36·2—36·3 ; mean 36·25.

Amount of Ammonia (sp. gr. 0·963) used.	C.c. of Cyanide consumed.	Copper found (apparent).	Error (mean).
60 c.c.	37·0—37·1	0·2041—0·2046	0·0043
80 ,,	37·6—37·8	0·2074—0·2085	0·0079
100 ,,	37·9—38·0	0·2090—0·2096	0·0093
120 ,,	38·1—38·2	0·2102—0·2107	0·0104

The Interference of Ammonium Chloride in Various Proportions with the Accuracy of the Process for Estimating Copper by Cyanide of Potassium.

In the experiments made on the interference of ammonium chloride, the same quantities of copper and ammonia were used as in the case of the metals, but the standard to which the results were referred was changed to the result obtained when *no* ammonium chloride was used. The extent of interference, as in the case of ammonia, does not rise in proportion to the quantity of ammonium chloride present, as will be seen by reference to Table III.

The Interference of Ammonium Nitrate in Various Proportions with the Accuracy of the Process for Estimating Copper by Cyanide of Potassium.

In the experiments made on the interference of this salt, the same quantities of copper and ammonia were used as in the experiments with ammonium chloride, and the results were compared with that obtained when no nitrate or chloride of ammonium was present. The interference caused by 2, 4, and 6 grms. of ammonium nitrate corresponds very closely to that caused by the same quantities of ammonium chloride, but the interference of 8 and 10 grms. differs entirely from that of the corresponding quantities of ammonium chloride, the former being considerably greater than the latter. The results are given in Table IV.

TABLE III.

Showing Results Obtained by the Cyanide Process for the Estimation of Copper in Presence of Ammonium Chloride in Various Proportions.

Amount of copper used, 0·2 grm.
Amount of NH_4HO (sp. gr. 0·963) used, 40 c.c.
Total volume of each solution before adding the cyanide solution, 150 c.c.
C.c. of cyanide consumed.

Amount of NH_4Cl used.	C.c. of Cyanide consumed.	Copper found (apparent).	Error (mean).
2 grms.	36·2—36·3	0·2077—0·2083	0·0080
4 ,,	36·9—36·9	0·2117—0·2117	0·0117
6 ,,	37·4—37·5	0·2146—0·2152	0·0149
8 ,,	37·6—37·6	0·2157—0·2157	0·0157
10 ,,	37·7—37·8	0·2163—0·2169	0·0166

TABLE IV.

Showing Results Obtained by the Cyanide Process for the Estimation of Copper in Presence of Ammonium Nitrate in Various Proportions.

Amount of copper used, 0·2 grm.
Amount of NH_4HO (sp. gr. 0·963) used, 40 c.c.
Total volume of each solution before adding the cyanide solution, 150 c.c.
C.c. of cyanide consumed.

Amount of NH_4NO_3 used.	C.c. of Cyanide consumed.	Copper found (apparent).	Error (mean).
2 grms.	36·2—36·3	0·2077—0·2083	0·0080
4 ,,	36·8—36·9	0·2111—0·2117	0·0114
6 ,,	37·5—37·4	0·2152—0·2146	0·0149
8 ,,	38·3—38·4	0·2197—0·2203	0·0200
10 ,,	38·6—38·6	0·2215—0·2215	0·0215

It is obvious from these results that, in the estimation of copper by cyanide of potassium, the presence of the common metals, with very few exceptions, must be avoided. It is also evident that great care must be taken as to the quantity of ammonia and ammonium salts present; indeed that the same proportion of these salts should be used in each estimation as is used in the standardising of the cyanide of potassium solution.

In conclusion, it may be noticed that the *slight* interference cause by some of the metals may be accounted for, in part at least, by the action of the salt of ammonium formed by the decomposition of the salt of the metal when the ammonia is added.

STATE OF ANIMAL CHEMISTRY IN AUSTRIA.

(OPEN LETTER TO THE IMPERIAL ACADEMY OF SCIENCES AT VIENNA, CONTAINING AN EXAMINATION OF THE RESEARCHES ON THE COLOURING MATTER OF BILE, BY RICHARD MALY, OF GRAZ.)

By J. L. W. THUDICHUM, M.D., London.

1. THE 72nd volume of the *Proceedings of the Imperial Academy of Sciences* (Part 3, October, 1875) contains a paper by Richard Maly, of Graz, entitled "On the Action of Bromine upon Bilirubin," which compels me to communicate to the Imperial Academy the following statement:—

2. The paper by Prof. Maly alluded to is described as the fifth of a series, the first and second members of

which are printed in the 57th and 59th volumes of the *Proceedings* of the Academy: the third paper is contained in *Liebig's Annalen* (vol. clxiii.); the fourth, again, in the *Proceedings* of the Academy (vol. lxx.). I am compelled to refer to these four previous papers by the contents of the fifth in the 72nd volume of the *Pooceedings* of the Academy.

3. In the introduction to the fifth paper Prof. Maly states that, through some experiments, undertaken with the view of learning something about the blue product of oxidation which nitric acid produces with bilirubin, he "has been led to the study and discovery of a body which was totally different from the one he had proposed to himself." Incidentally he remarks that his experiments are the fruit of a year's labour.

4. Prof. Maly next recants the opinion which he had maintained in all his former papers, and which in the second paper he had endeavoured to prove by many and laborious volumetric experiments, according to which the products of the action of bromine upon bilirubin owe their origin to a process of oxidation; and he then describes, after many remarks upon the alleged striking similarities between the action of nitric acid and that of bromine upon bilirubin, his great surprise on finding that the products of the action of bromine upon bilirubin are by no means oxidised, but contain bromine in substitution for hydrogen.

5. In a footnote Prof. Maly then states:—"After I had concluded the following research, and drafted the manuscript, I became acquainted with a research by L. W. Thudichum, 'Further Researches on Bilirubin and its Compounds,' which is contained in the lately-published (May) number of the *Journal of the Chemical Society*. I have learned from this that Thudichum also has recognised that the action of bromine upon bilirubin produces *bromo-products*; therefore this observation, which has also been made by Thudichum, is in any case, on account of prior publication, to be considered as his property."

6. I interrupt the quotation of the footnote in order to point out that Prof. Maly represents to the Academy that he had discovered the substitution by bromine, of hydrogen in bilirubin, by means of his own experiments; that he had himself independently found out and corrected his former errors, which he had maintained for years, and which have been repeated in many chemical publications; and particularly that he had only obtained knowledge of my researches after he had completed his research and written out the draft of his paper.

7. However, on June 11, 1874, I had directed a letter to Prof. Maly, in the course of which I had made to him the following communication, given in the words of the copy which I preserved:—"I was pleased that as regards biliverdin you now agree with me. You double the formula, but without giving any reason for it. However, in the course of time our agreement will, no doubt, become greater yet. You still believe, per example, that the products of the action of bromine upon bilirubin are products of oxidation, whereas I have shown already, two years ago, that they are products of substitution. Simple addition of bromine vapour to bilirubin gives—

$$C_9H_7Br_2NO_2,$$

and determines the atomic weight of bilirubin accurately at 163, the same number which results from all my other researches. Städeler has made many calculations to be enabled to use my analyses for the construction of a theory of a hexabasic acid, but has not succeeded. I rely upon numerous experiments and analyses, and these cannot be calculated away on paper."

8. That Prof. Maly had received the letter containing the foregoing passages is proved by the reply which he addressed to me, dated from Innsbruck, June 14 (1874), now before me. Prof. Maly, therefore, before he began the experiments which are so exhaustively described in the fifth paper, was not only informed of his error, but actually in possession of the key to his alleged discovery, and it was therefore impossible that he should have been led to this discovery by his experiments.

9. It is further quite clear, from the connection of the statement of Prof. Maly, that if he had not obtained information of my paper in the *Journal of the Chemical Society*, he would in that case also have ignored my letter to him, and would have claimed the priority of the discovery of the brominated product of bilirubin. For although, in the beginning of his fifth paper, he declares, as he expresses himself, "the characterisation of the hitherto existing knowledge concerning the blue product of bilirubin" to be a "usual duty," yet in enumerating previous data he neither mentions my letter nor the fact that I had published the existence of the bromo substitution-product of bilirubin already, in the year 1872, in my "Manual of Chemical Physiology" (London, 1872, p. 72), and had communicated this observation to the Chemical Section of the German Association for the Advancement of Science, at the meeting at Wiesbaden. He is perfectly silent regarding the numerous blue and variously coloured derivatives of the colouring matters of gallstones, which I was the first to characterise from my own researches, chemically as well as spectroscopically, in my Report in the 9th and 10th "Reports of the Medical Officer of the Privy Council" (1866 and 1867, pp. 251 to 260), and in the Manual alluded to. That these researches and publications should have remained unknown to the editor of an annual report on the progress of animal chemistry is not impossible, but that he excluded the contents of my letter from the circumference of the "usual duty" admits of only *one* explanation, but not of justification.

10. I now proceed to consider the representations concerning my results which Prof. Maly has made to the Academy, in the footnote already partially quoted, and in the appertaining text of his paper. This description leaves the main points which have been established by my researches entirely out of consideration, and in all particular statements it is completely incorrect. Indeed I can hardly believe that Prof. Maly has read my paper; it is certain he has not understood it.

11. In the note alluded to Prof. Maly says—"Thudichum has not analysed his body, but has only drawn a conclusion concerning its composition from the increase in weight which bilirubin undergoes when bromine vapour is passed over it. When bromine was passed for a short time Thudichum obtained a body which was soluble in alcohol with almost monochromatic blue colour, and contained 35·30 per cent Br; and this, in accordance with Thudichum's formula for bilirubin, is said to be monobromo-bilirubin, for which, however, calculation requires 33·0 per cent Br. This substance, from its properties, may correspond to the body which I describe in this paper, but without being approximately pure."

12. These statements are exclusively taken from the preliminaries of my paper, which I relate only because they lead to and necessitate the performance of my cardinal experiment. The product containing 35·30 per cent Br I have never declared to be mono-bromo-bilirubin; on the contrary, I have stated that by solution in concentrated sulphuric acid, and precipitation with water, to which it had been subjected, it had acquired different properties—among others, a green colour. I say expressly that the product before treatment with sulphuric acid appeared to have been a mixture of mono- and dibromobilirubin. I then assert that these bodies cannot easily be separated from each other by ordinary solvents.

13. Prof. Maly says further in the note—"When bromine is passed for a long time (over bilirubin), then, according to Thudichum, a body is produced which is yet richer in bromine, and this he claims to be bromo-bilirubin." And further in the text—"It is therefore" (namely, because according to Maly the proper point of bromination can only be discovered with the aid of solvents) "impossible to draw any conclusion regarding the composition of the products of the two experiments of Thudichum, in which bilirubin was exposed for some time to bromine vapour, and then weighed, for in this form the body is always fused like a resin."

14. This statement of Prof. Maly is not only contrary to my actual description, but is directly opposed to the stated motives which led to my experiment. For I say that it was evident, from the preliminary experiments, that bilirubin in the presence of hydrobromic acid and moisture could not be completely brominated, just because it deliquesced, and that for this reason I had instituted an experiment in which this accident was completely avoided.

15. I then describe the experiment as follows:—"A quantity of finely-powdered bilirubin was placed in a Liebig's drying apparatus, and dried at 100° C. in a current of dry air. Next, a current of dry air, which had passed over some dry bromine contained in a little bulb, was passed slowly over the bilirubin in the cold, as long as the bromine was absorbed. Care was taken to agitate the bilirubin, and keep it throughout in a mobile powdery state. When the bromine passed unchanged through the apparatus into the aspirator, the bromine bulb was removed, and dry air only was conducted through the apparatus. It was now found that the weight of the bilirubin had exactly become treble what it was at the beginning of the experiment. The apparatus was now heated to 100°, while a continuous current of dry air was passed through it. Much hydrobromic acid was removed, and after several hours of drying the weight of the apparatus became stationary.

Bilirubin employed dry at 100° C. = 1·2280 grms.
Bromine added $-2H$ at 100° C. = 1·1942 grms.

The equation—

Increase by Br : Wgt. of Bilirubin taken :: Atomic Weight of $2Br-H_2$: Atomic Weight of Bilirubin.

1·1942 : 1·2280 = 158 : 162·4.

This number of 162·4 is therefore the atomic weight of bilirubin as deduced by this experiment, and this is very close to 163 as deduced by all my other experiments (see *Erdmann's Journ. d. Pract. Chemie*, 104, 193). The atomic weight of 163 requiring an addition of 158 to form $C_9H_7Br_2NO_2$, requires by calculation an addition of 1·1903 to the bilirubin employed, which, again, is very near to the actual number found."

16. I further describe the properties of the new compound, and particularly that it becomes quickly changed in several solvents. It would have been more to the interest of Prof. Maly if he had studied my statements relating to these changes, and had repeated the experiments,—if he had heeded my warning, and excluded moisture and hydrobromic acid from his experiments: it would have saved him much disappointment had he comprehended that I saturated bilirubin with bromine by offering it an excess, and did not only, as Maly reports, pass it over it for some time. All these necessary precautions Prof. Maly has neglected, and in consequence has arrived at conclusions which have no foundation.

17. Prof. Maly further endeavours to influence the judgment of the Academy by raising doubts in general regarding my experiments; first, on the ground that I had performed each experiment only once; secondly, because I had not analysed the final product. Against these objections I maintain that the above experiment, considered by the light of my former researches in the *Journ. d. Pract. Chem.* (civ., 193), requires no further analysis. I thought and think every analysis of the product to be a mere waste of time,—every repetition on my part a waste of labour and material. However, in order to meet the objection, and from a high regard for the Academy, I have repeated the experiment described under 15, yet two several times, and have analysed the products by determining quantitatively the amounts of carbon, hydrogen, nitrogen, and bromine. I give here the results of the experiments and analyses, and observe, at the same time, that during the elementary combustion none of the hypothetical bromide of carbon was observed, with the alleged escape of which Prof. Maly endeavours to explain his discordant carbon-numbers.

(To be continued.)

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, April 7th, 1876.

Professor ABEL, F.R.S., President, in the Chair.

THE minutes of the previous meeting having been read and confirmed, and the presents made to the Society announced, the following names were read for the first time:—Messrs. C. G. Matthews, M. Hawkins Johnson, H. C. Jones, A. J. Brown, Purna Chandra Sen, E. Hunter, G. Allanby, H. A. Milnes, and D. Sullivan. Messrs. Thomas Berham Udall, M.A., and Josiah Christopher Gamble were duly elected, after their names had been read the third time.

The first paper, "*A Preliminary Notice on the Action of Sulphuric Acid on Naphthalene*," by Dr. J. STENHOUSE and Mr. C. E. GROVES, was read by the latter. (This is published *verbatim* at page 151 of this journal.)

Prof. T. E. THORPE communicated three notes from the laboratory of the Yorkshire College of Science. The first of these was "*On the Action of the Copper-Zinc Couple on Potassium Chlorate and Perchlorate*," by Mr. H. ECCLES. It has been found that the copper-zinc couple, when properly prepared, completely reduces the chlorates and iodates, so that this reaction may be made the basis of a quantitative method. As the couple is entirely without action on potassium perchlorate, the author has taken advantage of this fact to verify the statement that the decomposition of potassium chlorate, when heated, takes place in two phases, with the intermediate production of perchlorate.

The second of these notes was on "*Thallium Chlorate*," by Mr. J. MUIR. The author prepared the chlorate from thallium sulphate and barium chlorate in equivalent proportions, concentrating the filtered solution by evaporation. The salt forms anhydrous microscopic crystals of the formula $TlClO_3$. They are permanent in the air, and readily soluble in hot water without decomposition. The specific gravity of the crystals at 9° C. is 5·5047.

Mr. J. WILLIAMS said that some years ago he had occasion to prepare several pounds weight of thallium chlorate, which he did by decomposing thallium sulphate with barium chlorate, and could entirely confirm the author's statements with regard to the properties of the salt.

The last note was by Mr. THORPE himself, "*On the Isometric Relations of Thallium*." The author has compared various thallium salts with the corresponding potassium and ammonium compounds, and finds in many instances that their specific volumes are identical. This is the case with potassium and thallium chlorates, carbonates, and nitrates, and also with ammonium and thallium chlorides, sulphates, dihydrogen phosphates, hydrogen oxalates, and tartrates. These salts are isomorphous as well as isometric.

Prof. THORPE, in reply to a question put by Prof. McLeod, said he had not determined the molecular volume of any of the triad compounds of thallium.

The last paper was by Dr. H. E. ARMSTRONG, "*On the Nomenclature of the Carbon Compounds*." After adverting to the paper on this subject by Prof. Odling in the *Philosophical Magazine*, especially in relation to Schorlemmer's classification of the paraffins, he said that his main objection to Prof. Odling's system was that in going as far as it does, it did not go far enough. The speaker thought that a systematic nomenclature should indicate as clearly as possible the nature of the relation between the homologues and isomerides, and also that each member of the series of isomerides should bear the same root name, and that this should be disguised as little as possible by the index, prefix, or suffix employed to distinguish one member of the series from the other. He proposed to consider the alcohols as derivatives of methyl-alcohol, and adopting

Kolbe's nomenclature, to divide them into primary, secondary, and tertiary carbinols according as one, two, or three of the hydrogen atoms in carbinol, $CH_3.OH$, were replaced by monad radicals, and, further, to extend the terms primary, secondary, and tertiary to the aldehyds and acids as derived from acetic aldehyd, $CH_3.COH$, and acetic acid, $CH_3.COOH$. The method by which he proposed to distinguish the isomerides formed from the same parent substance by the introduction of isomeric radicals, was by the employment of the letters of the Greek alphabet, not merely to distinguish them one from the other, but also to indicate their position in the series; the member which has the highest boiling-point and specific gravity being placed first, the remaining terms being arranged in the order of their boiling-points; for it is difficult to avoid the impression that the physical properties, and what is termed the chemical constitution, of a compound are in some way correlated. This system was illustrated by reference to the alcohols. He proposed to call the two propylic alcohols $C_3H_5.CH_2.OH$, and $(CH_3)_2CH.OH$ α and β propylic alcohols respectively, and the corresponding monad radicals derived from these by the subtraction of OH, α and β propyl. By the substitution of an atom of hydrogen in carbinol by one or other of these two radicals we should have two primary tetrylic alcohols, α-propyl-carbinol and β-propyl-carbinol, besides a secondary alcohol, ethyl-methyl-carbinol $(C_2H_5)(CH_3)CH.OH$, and a tertiary alcohol, trimethyl-carbinol, $(CH_3)_3C.OH$. These four alcohols might be called α, β, γ, and δ butyl alcohols respectively, and the corresponding monad radicals would be α, β, γ, and δ butyl. In a similar way these radicals would give rise to four primary amylic alcohols, which, with the three secondary and one tertiary amylic alcohol, would yield eight corresponding monad radicals (amyls). By extending this principle to the C_6 series we could, in like manner, provide a systematic nomenclature for the hexylic alcohols.

The President said the importance of the subject introduced by Dr. Armstrong could not be over-estimated, for all workers in chemical research must wish for the attainment of something like uniformity in the nomenclature employed to distinguish the numerous isomeric compounds. He thought, however, that as there was comparatively little time that evening, it would be advisable to adjourn the discussion until the next meeting, Thursday, April 20. He would also remind the Fellows that there would be a Special Meeting on Friday, April 28, when Prof. Andrews would deliver a lecture "On Certain Methods of Physico-Chemical Research."

PHYSICAL SOCIETY.

April 8th, 1876.

Mr. W. Spottiswoode, Vice-President, in the Chair.

The following gentleman was elected a Member of the Society:—Mr. H. M. Klaassen.

Prof. Foster exhibited and described an instrument for illustrating the law of refraction. It is founded on the well known method of determining the direction of the ray after refraction by means of two circles described from the point of incidence as centre, the ratio of whose radii is the index of refraction. If the incident ray be projected to meet the inner circle, and through the point of intersection a vertical line be drawn, the line drawn from the point of incidence to the point where this meets the outer circle is the direction after refraction. This principle is applied in making a self-adjusting apparatus as follows:—A rod representing the incident ray is pivoted at the point of incidence, and projects to a point about 4 inches beyond. To this extremity is attached a vertical rod, which slides through a nut in another rod also pivoted at the point of incidence. The lower extremity of the vertical rod is attached to a link, so fixed as to constrain it to remain vertical. By this means the two rods always represent respectively the incident and refracted rays, and the index of refraction can be varied by altering the position of the nut, through which the vertical rod passes, on the rod to which it is attached.

Prof. Foster then exhibited a simple arrangement for showing the interference of waves. It consists of two glass plates, placed one in front of the other, on each of which is drawn the ordinary sine wave. They are supported in a frame, and behind them is a paper screen, bearing lines to indicate the points of maximum and minimum displacement. The plates can be made to slide in opposite directions, and all the phenomena of wave motion generally and the state of the air in open and closed tubes can be shown.

Lastly, he exhibited a method, which has been suggested by Prof. Kundt, for showing in a simple manner that the air in an organ-pipe is in a constant state of alternate condensation and rarefaction. At the upper end of a closed pipe are placed two valves opening inwards and outwards respectively, and the chambers behind these are connected by india-rubber tubes with small water gauges, which, for the sake of exhibition, were projected on the screen. The gauges were to the eye permanently set, showing at the same time condensation and rarefaction, an appearance which was, of course, due to the rapidity of change. It was shown that beats cause the air to approximate to its normal density.

Prof. Guthrie exhibited and described an arrangement which he thought might be useful for determining the rate at which machinery is revolving. The instrument is analogous to one which he devised some years ago for rendering a galvanic current constant. The chamber of a manometer is connected with a small force-pump, which makes one complete stroke for every revolution of the engine. A capillary glass tube affords a means of escape for the air introduced by the pump into the manometer. If now the pump be worked uniformly—that is, the engine rotates uniformly—the pressure in the manometer will shortly attain a position of equilibrium, so that the mercury will remain stationary. But if the velocity of the engine increase, the mercury will immediately ascend, and so indicate this increase of speed. The main objection to the instrument, as exhibited, was the oscillation of the mercury, but this might be avoided in several ways which were pointed out.

Mr. Coffin referred to some works in America where he had seen a similar principle applied. The engine was connected with an air-chamber, to which was applied a Bourdon's gauge, the indications of which gave an approximate measure of the revolutions of the engine.

Prof. Unwin thought there would be some difficulty in keeping the capillary orifice perfect for any length of time. He referred to a proposal made by Prof. Thomson in about 1852 to use a centrifugal pump for a similar purpose.

ROYAL SOCIETY OF EDINBURGH.

At the meeting held on the 3rd inst. Prof. Dittmar, of Glasgow, gave a description of two new laboratory appliances of his invention, viz., (1) of a modification of the *precision balance*, professing to enable one to execute exact weighings with great rapidity; and (2) of a *gas governor* founded on electro-magnetic principles.

The *new balance* differs from the customary instrument only in this, that two contrivances which are met with in every complete balance—viz., the rider arrangement and the "gravity bob"—are brought into new forms in which their potential usefulness is more completely exhausted. To enable one to dispense with weights less than 0·1 grm., both arms of the beam are graduated so that in each case both the 0 and the 10 mark are at accessible points of the respective arm, the 0 and the 10 on the left side being situated symmetrically to respectively that 10 and the 0 on the right. The right-side scale consists of the customary marks the left-side one of *notches* filed into the back of the beam. There are two riders, one weighing p centigrms.

for the left, and another weighing p milligrms. for the right scale, p being chosen so that, supposing the heavier (or the lighter) rider to be shifted towards the right through n divisions, this virtually amounts to the addition of n centigrms. (or milligrms.) to the charge in the right pan. The weight of this pan is so adjusted against that of the left one that the balance is in equilibrium when the two riders are suspended at their respective zero-points. The gravity-bob arrangement differs from the customary one in this, that the bob (which is very small) is fixed by *mere friction* to a triangular rod forming part of the needle, so that, by a mere touch with the finger or forceps, the bob can be made to pass from the top end to the bottom end of the rod, matters being arranged so that when the bob passes from the latter to the former position the sensibility increases in an exactly pre-determined ratio—for instance, in the ration of 1 : 10. The author does not consider it necessary to explain the way in which the balance is meant to be worked; he prefers, by way of appendix, to direct attention to the following inferences from the theory of the balance, which, obvious as they are, he thinks have hitherto not been sufficiently appreciated by either the authors of our physical handbooks or by practical balance makers.

Given a balance in which everything is constant except the distance s of the centre of gravity of the beam from the axis of rotation, and it is easily shown that, supposing s to vary, the tangent value α of the deviation corresponding to a given overweight Δ; or, with other words, the sensibility $\frac{\alpha}{\Delta}$ is inversely proportional to s. This, of course, is duly stated in all handbooks. But what is always forgotten to be added are two things, viz., (1) that this sensibility has nothing to do with the *inherent precision* of the instrument (which, in fact, is a function of only the practically unavoidable inconstancy λ in the arm-length); and (2) that supposing the sensibility to be increased (by diminishing s) all the other good qualities of the balance get less. We diminish the rate of vibration, this rate being, as is easily shown,—

$$\propto \text{ to } \frac{1}{\sqrt{\frac{\alpha}{\Delta}}};$$

we diminish the range of overweight determinable by the method of vibrations; we diminish the relative constancy, in opposition to variations in the charge, of the sensibility, and of the time of vibration. If, now, physicists or opticians would only present us with some simple arrangement which, without any visual effort on the part of the operator, would apparently magnify the linear magnitudes of the excursions of a balance needle to, say, ten times their real value, the problem of constructing a quick-working precision balance would then be solved quite satisfactorily.

The author is indebted to Messrs. Becker and Sons for having realised his ideas in an actual instrument, which, he states, is now being exhibited at South Kensington. To increase the usefulness of the balance, the author has caused Messrs. Becker to add to it a glass plunger displacing exactly 10 grms. of water of 15° C., and consequently enabling one to determine specific gravities of liquids with great rapidity by the method of immersion.

In the new *Gas Governor* the most essential part is a mercury manometer, of which the one limb—which communicates with the gas-pipe on the one hand, and the gas-lamp on the other—is about 20 m.m. wide, and stands vertical, while the other is of the width of a thermometer-tube, and lies horizontal. The bulk of the mercury is adjusted so that—supposing the gas pressure in the supply pipe to be at its minimum—the mercurial index in the horizontal limb stands at some definite convenient point, a. With the manometer there is connected an electro-magnetic arrangement in such a manner that, whenever the index travels ever so little to the wrong side of a, the current is closed, and, by converting a certain iron lever into a magnet, shuts off the gas. Of course there is a spring in connection with the gas-tap, which opens the tap as soon as the mercury has gone back to its original position.

GLASGOW PHILOSOPHICAL SOCIETY.

(Chemical Section).

March 27, 1876.

Professor John Ferguson, M.A., President, in the Chair.

Dr W. Wallace, F.R.S.E., F.C.S., read a paper on "*Germination, particularly with reference to the Preparation of Malt.*" He said that, in conjunction with Dr. Stevenson Macadam, of Edinburgh, he had occasion some months ago to make a rather extensive series of experiments on the germination of barley and on the properties of malt; and the object of his paper was to state briefly some of the results arrived at. The object of the researches was to ascertain whether or not grain which had once germinated and been kiln-dried, as in the manner of malt, would, under favourable circumstances, germinate again, and also whether barley might resist the process of malting in the first instance, and afterwards germinate. After making a few general observations on germination, he went on to say that in the preparation of malt there were four stages:—1, the steeping; 2, the couching; 3, the flooring; and 4, the drying. The steeping, he said, was performed in large stone or wooden cisterns, the barley being completely covered with water. In course of time it swells up, and increases about one-fifth in bulk and one-third in weight. The process occupies two days, the water being then drawn off, and the grain couched or laid out in square heaps, so that it may be accurately measured by the excise officer. After the lapse of twenty-four hours it is laid upon the malt-house floor, when there is developed a considerable rise of temperature; growth goes on vigorously, the little radicles or rootlets appearing at one end of the grain, while the plumule or acrospire extends in the opposite direction under the integumentary coating of the seeds. To prevent too rapid growth, the grain is spread to the depth of only a few inches on the floor, and frequently turned over. The greatest rise of temperature during any part of the process is about 10° F., but by turning over and spreading out it is kept down, so that it is seldom that the temperature is over 60° F. The time on the floor is usually about seven days, but sometimes during cold weather a longer time is necessary, in order to develop the germinating process to a sufficient extent. The grain is then removed to the kiln, on which it is gradually dried, the temperature on the first day reading about 110° F.; and the drying is finished in three days, the temperature finally becoming about 140°.

During the germination sugar is produced by the alteration of and absorption of the elements of water by the starch, and the extent to which the process has been carried may be roughly estimated by the amount of solid extract dissolved out of the crushed malt by the action of alcohol. In three samples of raw barley tested in this way the author obtained 2·74, 2·72, and 2·74 per cent of dissolved matter; and in seven samples of malt the quantities of extract so dissolved out were, respectively, 7·42, 9·28, 8·00, 8·00, 7·82, 7·80, and 8·88 per cent, the average being about 8·27 per cent. In a sample of "liebacks"—that is, grain which had passed through the malting operation without germinating—the solid extract weighed 4·24 per cent.

In the malting of barley much depends upon the condition of the grain. In the beginning of winter, especially if the barley is not well desiccated, a large proportion of the grains do not germinate, and the number of the "liebacks" is great—it may be 25, 30, or even, in extreme cases, 50 per cent. The same grain if kiln-dried before

malting gives a much better result, the "liebacks" being much reduced in number. Now, said the author, it is evident that the "liebacks" in the first instance could not have been dead grain, for if so no amount of kiln-drying, or any other treatment, could have restored their vitality. If the grain is well dried as the season progresses its germinating power gradually improves, but if not well kept there will inevitably be a large proportion of "liebacks."

"Liebacks" consist of two distinct kinds of grains,—those which are dead, and which, like addled eggs, no power can restore to life; and those which are merely backward in germinating, and which in malting, especially when insufficient time is given, show no radicle or acrospire. These have their germinating power increased by the kiln-drying following the malting process, and afterwards germinate pretty freely. Malt germinates a second time,—at least a certain proportion of the grains sprout again, but they differ from "liebacks" in producing, when tried in the ordinary way by being placed between folds of moistened blotting-paper, only a plumule, and no radicle. When planted in the earth, however, the effect is different. The grains of malt not only germinate a second time, but also produce plants, some of which the author has grown to the extent of 5¼ inches in 21 days, while raw barley grew about 8 inches in the same length of time. But only a limited number of the malt grains grew,—in some cases only 4 per cent, in others as many as 38 per cent. The author offered the following explanation of these facts:—In their fully developed condition the plants of barley have seven rootlets; that is the nominal number, but they are not all developed at once. He took twelve plants of barley, all grown to about 8 inches in height, and he found that eight had the normal number of rootlets, namely, 7; one had 6, and three had only 5. If these last four plants had had a little more time given them they would all have developed the normal number of rootlets. If, again, ordinary malt be taken in its various stages of progress, it will be found that in almost all cases the rootlets develop gradually, so that there are in some cases 2, in others 3 or 4 radicles, and so on up to the complete number 7, the others being rudimentary or as yet altogether undeveloped. In those cases where the full number of rootlets have grown, and the grain has afterwards been kiln-dried, no amount of coaxing can induce it to re-germinate. The plumule may swell out and extend a little, but in a day or two it dies down and begins to mould. But in other cases it is entirely different; the rootlets that were not developed during the malting now appear,—somewhat tardily it is true, but they do come eventually,—and the result is that a plant is formed; not so large, certainly, as one grown from raw barley, but still a good healthy plant. These plants, however, are not perfect; they resemble a man who has been accidentally deprived of one of his limbs; they never have, and as a matter of fact they never do have, their full complement of rootlets. The author examined ten plants grown from malt, and found that in three weeks—

2	had	1 rootlet
3	,,	2 rootlets
3	,,	3 ,,
1	,,	4 ,,
1	,,	0 ,,

The one which had no rootlets was very feeble, but still it was not moulding like those that were not growing at all; and if the experiment had been continued longer the plant would probably have thrown out a single rootlet.

Then as to "liebacks" which in the malting had not germinated at all, the author found them to be of two kinds: a large proportion were dead, and those which did grow formed perfect plants with a full number of rootlets; and this, he said, makes it difficult to distinguish raw grain mixed with malt from raw grain.

Hitherto it has been assumed (1) that "liebacks" are dead grains, that have not sprouted simply because they *are* dead, which the author has already shown to be absurd and contrary to fact, for, if dead, kiln-drying could not restore their germinating power; and (2) that malt which has sprouted well and been properly developed, and which has afterwards been dried in the kiln, may throw up a plumule of an inch in length or so, but will then die down, and under no circumstances produce rootlets and form a healthy plant. This, the author says, he has shown most conclusively to be incorrect.

The results obtained with various samples of malt were very different, and the author has been led to believe that malt will not germinate at all unless the experiment is made within a year or so. He tried some malt which was only two years old, and could not get any of it to grow; and even some samples which were comparatively fresh gave no plants, while others germinated freely, giving in one instance 38 per cent of plants. Probably a good deal depends upon the heat of the kiln, which if too high would undoubtedly kill all life, either of raw grain or malt. But the age of the malt has also something to do with it, for malt which will sprout freely when comparatively new will refuse to grow if kept for a couple of years. On the other hand, raw barley, if kept dry, appears to preserve its vitality for almost any length of time. Malt, in consequence of the changes in the original constituents of the grain, will probably attract moisture more freely than barley, and so become spoiled in an atmosphere that would not be injurious to raw grain.

Although the immediate object of his enquiry had already been attained, and his experiments all ruthlessly stopped, Dr. Wallace expressed a hope that he would, during the coming summer, be able to sow a larger quantity of malt, and prove still more conclusively, if it were necessary, that malt, although "scotched," is not killed; and, in conclusion, he said that he had found that the malt which contained the fewest "liebacks"—in other words, the most perfect malt—gave the largest number of healthy plants. That sample which gave 38 per cent of plants contained only 2 per cent of "liebacks."

A discussion followed, in which Messrs. Arrol (a practical brewer), John Jex Long, Tatlock, Coleman, Wood, Mayer, and the President took part. The remarks made by the various speakers had reference chiefly to the influence exerted by air, and by sunlight, and light passing through windows of yellow or blue glass in the malt-house, upon the process of germination. One of the speakers stated that he had seen the windows of a malt-house actually glazed with blue glass.

CORRESPONDENCE.

GENERAL INDEX.

To the Editor of the Chemical News.

Sir,—I am sure that a General Index to the whole series (or say to even thirty volumes) of the Chemical News would be of immense utility, and would be appreciated by its readers. The main question is, I suppose, *how much* it would be appreciated, if at the cost of production. It is, I think, difficult to overvalue such a work. It often happens to me to have to search nearly the whole series to find a desired note, and I for one should think relief from such trouble and loss of time cheaply purchased at the cost of, say, an average volume.—I am, &c.,

Sydney Gibbons.

Melbourne, January, 1876.

CAUSTIC SODA.

To the Editor of the Chemical News.

Sir,—In the Chemical News (vol. xxxiii., p. 137) Dr. Ph. Pauli writes to say that Mr. McBryde, of the Union Alkali Works, St. Helens, was the "original inventor" of the "process of making white caustic soda." Dr. Pauli relates that in July, 1860, he was appointed chemist to

Messrs. Evans and McBryde, and that he was informed by Mr. McBryde that "the year before" (1859 I presume) "he had heated caustic soda to redness, and oxide of iron separated out," &c.; and at the meeting of the British Association at Manchester, in 1862, Dr. Pauli exhibited a large sample of this white caustic soda, and it was then generally acknowledged to be a perfectly new commercial product.

I beg this opportunity of supplementing these statements and dates. We commenced the manufacture of caustic soda at these works, under Mr. W. Jowage's patent of the 18th May, 1853, on the 7th August, 1857. On the 17th September, 1857, we made our first batch of white caustic, just as Mr. McBryde did in 1859,—*i.e.*, by heating to redness and separating the iron, &c. Of course we went the usual round of blue, green, &c., and, amongst other common varieties, a speciality of hydrated crystals. The British Association usually meets about August: 1862 was also the year of the International Exhibition in London, which opened in May. My firm exhibited white caustic soda at that Exhibition, say four months earlier than Dr. Pauli's exhibition of it in Manchester. I do not know if we are the "original inventors" of this process; in fact the separating of iron, when caustic soda is made red-hot for the first time, is not the only phenomenon that occurs, as Dr. Pauli himself has pointed out that graphite is often separated at the same time; but it is precisely one of those things that manufacturers as a rule are more ready to utilise than to talk about. And, besides that, the separation of iron, &c., under the circumstances, is so necessary a consequence, and the heating red-hot almost so inevitable a consequence of making caustic soda on the large scale, that I quite expect to hear that some of the caustic soda makers who had begun before us—such as Messrs. J. C. Gamble and Son, of St. Helens, or others—have a better right to the title of original inventors of this process than ourselves. In fact I question very much if it be such a process as to admit of having been "invented" at all.

In connection with this history, the following extract from the specification of a patent granted to Mr. George Brown, a partner in the firm of Mesrs Charles Tennant and Co., of St. Rollox, will interest some of your readers. The patent is dated February 20, 1845. "Red liquor . . . is brought into a metal pan and evaporated to about the consistency of tar: the proper quantity of nitrate of soda is then added, and heat applied to expel the remaining water and flux the mass," &c.

Whilst I have my pen in hand, as something has recently been said about Mr. Lee being the first to introduce the present form of salt-cake decomposing-pots, may I ask if the following is not about the outline of the dates and facts? March 14, 1839: a patent by Mr. J. C. Gamble for some arrangement of iron retorts, &c., which were flat and containing false bottoms, all of cast-iron. An action-at-law between Mr. Gamble and Mr. Lee, and the purchase by Mr. Lee of a patent granted to Mr. Lutwyche on October 13th, 1836, and defeat of Mr. Gamble's suit, and filing of a disclaimer by him in consequence. Mr. Lee's adoption of "pots" like the bowl of a spoon, the broad end towards the workman and the narrow end for pushing up into the calcining furnace. A second suit-at-law between Mr. Gamble and Mr. Lee, the former being a second time defeated, and the adoption by Mr. Gamble of round "pots," smaller and deeper than now common, covered, and contained in an outer "pot," but much nearer the present shallow, uncovered, and unprotected "pot" than Mr. Lee's spoon-shape. Whether Mr. Lee, or who, was the first to remove the lid, or cover, and the "shell," I do not know; but Mr. Gamble's somewhat rectangular, Mr. Lee's spoon, and Mr. Gamble's round, I believe is the order in which the forms followed each other.—I am, &c.,

Henry Deacon.

Alkali Works, Widnes, Lancashire,
April 6, 1876.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances, de l'Academie des Sciences. No. 12, March 20, 1876.

New Rays of Calcium.—A letter from Mr. Lockyer to M. Dumas relating to the supposed dissociation of calcium: will be given in full.

Actinometric Measurements taken on the Summit of Mont Blanc.—M. J. Violle.—The author tabulates his observations, and announces his intention of giving the results arrived at in a future communication.

Approaching Maturity of the Winter Eggs of the Phylloxera.—M. Balbiani.

Influence of Temperature upon Magnetisation.—M. J. M. Gaugain.—The author finds that when a bar of steel placed in contact with a magnet is heated gradually till it takes a blue tint, the magnetisation increases at first, attains a maximum, and then retrogrades. When the bar, after having been strongly heated, remains in contact with the magnet during all the time of its cooling, the total magnetisation increases as the bar cools, and when the latter has resumed the temperature of the surrounding medium it proves a value much higher than what it had during the heating of the bar.

Rock Intervening between the Gneiss Rocks of Mantiqueiro (Brazil).—M. H. Gorceix.—This rock approximates to epidote, and appears to consist of a single mineral, with the exception of some small granules of infusible quartz. Its specific gravity is 3·4; it fuses easily, leaving a black slag, the specific gravity of which is only 2·86; its hardness is between 6 and 7. The composition of this rock is—

Silica	38·5
Alumina	25·1
Lime	23·2
Protoxide of iron	10·4
Magnesia	traces
Loss on ignition	2·6
	99·8

Gazzetta Chimica Italiana.
Anno vi., 1876, Fasc. i.

Use of Phyllocyanin as a Reagent.—Guido Pellagri.—Phyllocyanin, the blue colouring matter of flowers, is a reagent which may render some service in chemistry on account of its exquisite sensibility to the least traces of alkali. It is best preserved along with such a slight trace of acid as may give it a dull purple colour. Phyllocyanin will prove a valuable substitute for litmus in volumetrical operations, as there can be no doubt as to the end of the reaction. The following table shows its sensitiveness as compared with litmus:—

Potash.	Phyllocyanin.	Litmus.
1/500	Transient green, then yellow.	Distinct reaction.
1/1000	Green rather stable, and then yellow.	" "
1/2000	Stable green.	" "
1/5000	" "	" "
1/10000	" "	Reaction scarcely manifest.
1/20000	At first green, then stable blue.	" "
1/50000	Stable blue.	No reaction.
1/100000	" "	" "

Phyllocyanin is most readily obtained from the iris and the blue violet.

Revue Universelle des Mines, de la Metallurgie, de Travaux Publics, des Sciences et des Arts Appliques a l'Industrie, January and February, 1876.

Procedure for Detecting Arsenic in Paper-Hangings and in other Combustible Matters.—M. Kupfferschlæger.—Schweinfurt-green, known also as mitis-green and mountain-green, is a compound of the arsenite and acetate of copper too frequently used, in spite both of advice and of legal prohibition, for colouring paper-hangings, ball-dresses, artificial flowers, wafers, bon-bons, and toys. Every winter we hear of needlewomen experiencing serious affections after having made up costumes of tarletan coloured or printed with Schweinfurt-green; that dancers wearing similar materials, and with wreaths of artificial flowers in their hair, experience violent headache on the morning after the ball; that similar symptoms have been experienced by persons who have slept for some nights in rooms papered or painted with green; and, lastly, that children have been seized with vomiting after having eaten bon-bons or sucked toys coloured green. The author's method of detection is as follows:—The stained paper, divided into strips is placed in a porcelain soup-plate, and covered with a solution of chlorate of potash saturated when hot, and the whole is heated in the water-bath till the paper is completely dry. Then it is set on fire, and instantly covered with a large glass bell so that nothing may be lost. The ash is pulverised, and immediately exhausted in the cold with the water which has served to rinse out the bell and the plate after the combustion. Thus all the arsenic combined with the potash is dissolved, and not the oxides of chrome, copper, aluminium, and of tin and lead if present. This colourless solution, filtered, and mixed with sulphuric acid till a slight acid reaction is distinguished, is then introduced into a Marsh's apparatus which has been submitted to a blank test, and found free from arsenic.

MEETINGS FOR THE WEEK.

TUESDAY, 18th.—Civil Engineers, 8.
WEDNESDAY, 19th.—Society of Arts, 8.
Meteorological, 7.
THURSDAY, 20th Chemical, 8. Adjourned Discussion on Dr. Armstrong's Paper on "Systematic Nomenclature." "On the Manufacture of Sulphuric Anhydride, Experimentally Illustrated," by Dr. Messel and Mr. Squire. "On Glycerine-Phosphoric Acid, and on Fermentation," by Dr. Thudichum and Mr. Kingzett. "Note on the Occurrence of Benzene in Rosin Light Oils," by Watson Smith. "On the Action of Water and Various Saline Solutions on Copper," by Thomas Carnelly.

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THE CHEMICAL NEWS.

Vol. XXXII. No. 856.

ON THE MOVEMENT OF THE GLASS CASE OF A RADIOMETER.*

By WILLIAM CROOKES, F.R.S., &c.

During the discussion which followed the reading of Prof. Reynolds's and Dr. Schuster's papers, at the last meeting of the Royal Society, I mentioned an experiment which confirmed the observations of Dr. Schuster. I have since tried this in a modified form; and as the results are very decided, and appear calculated to throw light on many disputed points in the theory of these obscure actions, I venture to bring a description of the experiment, and to show the apparatus at work, before the Society.

I made use of a radiometer described in a paper communicated to the Society in January last. I quote the description from paragraph 184:—"A large radiometer in a 4-inch bulb was made with ten arms, eight of them being of brass and the other two being a long watch-spring magnet. The disks were of pith, blackened on one side. The power of the earth on the magnet is too great to allow the arms to be set in rotation unless a candle is brought near, but once started it will continue to revolve with the light some distance off."

This radiometer was floated in a vessel of water, and four candles were placed round it so as to set the arms in rotation. A mark was put on the glass envelope so as to enable a slight movement of rotation to be seen. The envelope turned very slowly a few degrees in one direction, then stopped and turned a few degrees the opposite way; finally it took up a uniform but excessively slow movement in the direction of the arms, but so slow that more than an hour would be occupied in one revolution.

A powerful magnet was now brought near the moving arms. They immediately stopped, and at the same time the glass envelope commenced to revolve in the opposite direction to that in which the arms had been revolving. The movement kept up as long as the candles were burning, and the speed was one revolution in two minutes.

The magnet was removed; the arms obeyed the force of radiation from the candles, and revolved rapidly, whilst the glass envelope quickly came to rest and then rotated very slowly the same way as the arms went.

The candles were blown out; and as soon as the whole instrument had come to rest a bar-magnet was moved alternately from one side to the other of the radiometer, so as to cause the vanes to rotate as if they had been under the influence of a candle. The glass envelope moved with some rapidity (about one revolution in three minutes) in the direction the arms were moving. On reversing the direction of movement of the arms the glass envelope changed direction also.

These experiments show that the internal friction, either of the steel point on the glass socket, of the vanes against the residual air, or of both these causes combined, is considerable. Moving the vanes round by the exterior magnet carries the whole envelope round in opposition to the friction of the water against the glass.

As there is much discussion at present respecting the cause of these movements, and as some misunderstanding seems to prevail as to my own views on the theory of the repulsion resulting from radiation, I wish to take this opportunity of removing the impression that I hold opinions which are in antagonism to some strongly urged explanations of these actions. In the arguments which Prof. Reynolds has credited me with, in the paper which was read last Thursday, I fail to recognise my own ideas. I have on five or six occasions specially stated that I wish to keep free from theories. During my four years' work on this subject I have accumulated a large fund of experimental observations, and these often enable me to see difficulties which could not be expected to occur to an investigator who has had but a limited experience with the working of one or two instrument.s

* A Paper read before the Royal Society, March 30, 1876.

STATE OF ANIMAL CHEMISTRY IN AUSTRIA.

(Open Letter to the Imperial Academy of Sciences at Vienna, containing an Examination of the Researches on the Colouring Matter of Bile, by Richard Maly, of Graz.)

By J. L. W. THUDICHUM, M.D., London.

(Concluded from page 156).

18. 0·5570 grm. dry bilirubin was treated as described in the above experiment under 15. At no period of the experiment did the substance assume a green colour: it became, however, tolerably warm. After the absorption of bromine vapour had completely ceased, the product was left for twelve hours longer in the bromine atmosphere, and then freed from all bromine vapour by a current of dry air. The dark purple substance now weighed 1·1646 grms., corresponding to an addition of a little more than four atoms of bromine. The excess amounts to 0·0712 grm., and is evolved subsequently on heating. The compound must therefore be considered as—

$$C_9H_7Br_2NO_2,+2HBr.$$

The combination with HBr is, however, very loose, so that, similar to many hydrates, it is gradually decomposed by passing a current of air over it for a very long time, or quickly by heating it to 100°, all hydrobromic acid being at the same time expelled. At the same time the substance contracts to a smaller volume, but fuses in no manner or measure, and remains perfectly powdery. After many hours drying in the current of dry air at 100°, the increase in weight amounted to 0·5312 grm. Consequently 2 atoms of bromine had entered the bilirubin with expulsion of 2 atoms of hydrogen, and the atomic weight of bilirubin is 165—again very near to the figure 163 already mentioned.

19. The elementary analysis of this product yielded—

a. 0·1066 grm. gave 0·1210 silver bromide = 48·31 per cent Br.

b. 0·385 grm., burned with lead chromate, gave 0·4750 CO_2 = 33·64 per cent C, and 0·1150 H_2O = 3·31 per cent H.

c 0·315 grm., burned with copper oxide, gave 13·1 c.c. nitrogen gas normal = 5·16 per cent N.

The preparation marked I. in the table below had been made by myself; the analyses were executed by my assistant, Mr. C. T. Kingzett. Several bromine determinations executed by my assistant, Dr. H. Hake, completely confirmed the theory to be seen below.

20. Further, Dr. Hake has executed the bromination of a third preparation (tabulated below as II.), under my superintendence, with all the precautions described, and has obtained results which fully confirm the foregoing.

a. 0·4502 substance gave 0·5277 silver bromide = 49·87 per cent Br.

b. 0·2314 gave 9 c.c. N normal = 4·86 per cent N.

c. 0·3043 gave 0·3760 CO_2 = 33·69 per cent C, and 0·0978 H_2O = 3·56 per cent H.

These results compare with the theory of $C_9H_7BrNO_2$ as follows:—

	Theory.	Found.	
	Per cent	I.	II.
C	33·64	33·64	33·96
H	2·18	3·31	3·56
Br	49·84	48·31	49·87
N	4·36	5·61	4·86
O	9·98	9·58	8·02

It is unnecessary to accumulate figures, and impossible here to discuss the excess of hydrogen, which might possibly require an increase of the figure for hydrogen in the formula. These variations from theory, however important they appear to me, effect no difference in the great features of the fact that in this product—

$$C : N : Br = 9 : 1 : 2,$$

and that it therefore fully confirms the theory of the red colouring matter of gallstones, which I have maintained since 1865.

21. In his remarks on the formula assumed for his bromine product, Prof. Maly says—"The most simple expression of the composition of bilirubin is, according to the analyses of Prof. Städeler and myself, $C_{16}H_{18}N_2O_3$." In making this statement Prof. Maly loses sight of "the usual duty of characterising previous knowledge," or other knowledge. I therefore felt myself called upon to search for the analyses of Prof. Maly, of which he claims that they prove the above formula, but with the exception of one carbon and two hydrogen determinations, in the *Reports of the Vienna Academy* (1868, vol. lvii., p. 97). I could not find any proofs of this assertion. In particular, Prof. Maly has not made any determinations of the nitrogen, and, above all, no determination of the atomic weight, and has not even subjected his results to control on different preparations. For these reasons I consider his formula as of little significance opposite my theory, which is based upon numerous preparations and well-defined compounds, and now more than fifty elementary analyses.

22. Prof. Maly, in the paper just quoted, supports his formula for bilirubin by the authority of Städeler, but on p. 102, note 2, he censures the proceedings of Städeler, who had produced a formula for biliverdin by re-calculating an old analysis of Heintz, which had been executed upon material declared by Städeler himself to have been a mixture of pigments. Prof. Maly himself points out that this proceeding was characteristic of the work of Städeler. I dare not trouble the Academy with a criticism of the researches of Städeler, particularly as I have given one in my paper contained in the *Journal of the Chemical Society*, 1875, I think it, however, necessary to direct the attention of the Academy to the circumstance that the doubling of the formula $C_{16}H_{18}N_2O_3$ into $C_{32}H_{36}N_4O_6$—which Prof. Maly introduces in the fifth paper, in 1875, as a necessary consequence of his discovery of a brominated compound, and then further particularly as a novelty—had already been adopted by Städeler, before 1870, in a letter to the editor of "Gmelin's Handbuch," Herr Karl Kraut, and been published by the latter in an Appendix to the last volume of the "Handbuch." In the letter alluded to, Städeler, in view of my researches, abandons all his former formulæ, and coerces my results by an utterly unjustifiable process of re-calculation, in which no single analytical result harmonises with the new hypothesis into some sort of support for his doubled formula and hexa-basic acid hypothesis, without having produced a single compound or made a single new analysis.

23. Prof. Maly causes to himself many difficulties by his preconceived opinions and uncontrolled imagination, as I am obliged to prove now more in particular. At first he believed every green product of the colouring matter of gallstones to be "biliverdin:" thus the product by chloroform and glacial acetic acid, which seduced him into the belief that he had transformed bilirubin, an alleged amide, into ammonia, on the one hand, and an acid free from nitrogen, viz., biliverdin, on the other; and, what was still more surprising, that he had re-transformed this acid into the original amide, bilirubin, by simply mixing it with ammonia (see "Preliminary Communication on the Colouring Matter of Bile"—*Reports of the Meetings of the Vienna Academy*, vol. xlix.). A part of this conclusion Prof. Maly has withdrawn (*Reports of Vienna Acad.*, 1868, p. 98), namely, the one concerning the decomposition of bilirubin into ammonia and "biliverdin." The ammonia which he had found he now explained to have been an impurity of his preparation. But in 1868 he still insisted upon the proposition that the product of heating bilirubin, glacial acetic acid, and chloroform, in sealed glass tubes, was "biliverdin." To this opinion he was probably led by the green colour only; at least he advanced no analytical proof in its support, and it will probably be long ere this will be forthcoming. I have explained the circumstances attending the experiment of Prof. Maly in my paper, and therefore refer to it.

24. For a long time he also believed his brominated product to be "biliverdin" (*Vienna Acad. Reports*, 1868, p. 104). I have shown that in its first form it was a mixture of blue brominated bilirubin with orange bilirubin: this Prof. Maly now admits himself, in his fifth paper, as his original discovery.

25. In the fifth paper Prof. Maly again produces "biliverdin," by treating the brominated product with alkalies. But it contains always yet a small trace of bromine, and a little ash, which is deducted. In the analyses 3 and 4 of his former "biliverdin" (*Vienna Acad. Reports*, vol. lvii,, p. 105) he was even obliged to deduct as much as "Circa 2 Pet." of ash. How can an author who works with such preparations call others to account for the alleged impurity of their preparations!

26. In short, Prof. Maly is unacquainted with the fact that there is a great number of derivatives of the colouring matter of gallstones, which all have this in common, that they are *green*, but are not for that reason alone biliverdin ($C_8H_9NO_2$). Thus the green cholothallin obtained by the action of oil of vitriol upon bilirubin, and subsequent treatment with water, is bilirubin to which the elements of water have been added. By the action of bromine, and particularly hydrobromic acid, at least three green products are produced, which all contain bromine, viz., hydrobromo-bilirubide, C_9H_8BrNO, containing 35·39 per cent Br; further, a compound of this body with bilirubin, $C_9H_8BrNO + C_9H_9NO_2$, requiring 20·50 per cent Br, actually found in it 19·68 per cent Br; further, a mixture of this body with a further molecule of hydro-bromo-bilirubide, therefore about $C_{18}H_{17}BrN_2O_3 + C_9H_8BrNO$, which contains 27·945 per cent Br, and is probably nothing else than the product described in Maly's fifth paper.

27. The Academy may justly demand of me to prove these statements. I am ready, on receiving a request to that effect, to communicate to the Academy details, the extent of which are excluded from the present letter on account of their length. I will, however, state the principles, found by experiment, upon which my conclusions are based:—

a. Bromine, acting upon bilirubin, produces probably at first monobrominated bilirubin, $C_9H_8BrNO_2$: this body is blue; it has neither been obtained in the pure state nor analysed.

b. Bilirubin saturated with bromine becomes dibromo-bilirubin, $C_9H_7Br_2NO_2$, which body is violet.

c. Bilirubin heated with hydrobromic acid in chloroform becomes hydro-bromo-bilirubide-bilirubin, $C_9H_8BrNO + C_9H_9NO_2$: this body is green.

d. The bodies under *a* and *b*, when treated for some time and at elevated temperatures with alcohol, or ether, or with oil of vitriol, and then water, are changed first to hydrobromo-bilirubide, C_9H_8BrNO,—therefore a product of reduction,—and afterwards into bodies which, in solution, constantly lose bromine, and ultimately (probably or perhaps) become quite free from bromine.

28. Prof. Maly operated with bromine in moist chloroform. Every molecule of bromine yielded him a molecule of hydrobromic acid, which now in its turn attacked the bilirubin. The moisture precipitated the mixture. The precipitate consisted proximately of bromo-bilirubin, with some hydrobromic acid, of which it yet lost some on drying, and of perhaps little hydrobromo-bilirubide, for the action of HBr requires more time than that of Br. But now the product was put in alcohol, which immediately began its reducing action. Consequently the powder was

"dark blue-green," while the probable monobromo-bilirubin is monochromatic blue, as I state in my essay (and not "nearly" monochromatic blue, as Prof. Maly reports my description).

29. Again, the ethereal solution which Prof. Maly obtained when treating bilirubin in ether with bromine was "dark greenish blue," and became blue only when the monobromo-bilirubin prevailed, by means of its greater absorptive power for green. The residue of this ether process was "always in thin layers, green." This change from blue to green was evidently the reason which caused Prof. Maly to abstain from further attempts at purifying his products. The incessant loss of bromine which the products of substitution, as well as of reduction, experience in alcohol or ether, is so great and marked that in some of my experiments the amount of bromine fell from 49·8 to 16 per cent, and the violet product, which had been soluble in ether with a violet colour, became green, quite insoluble in ether, but soluble in alcohol with a green colour.

30. After the foregoing I hardly know whether there is any part of Prof. Maly's research left which requires refutation or explanation, excepting perhaps the remarkable results of his carbon determinations in which the carbon found varied between 35·51 and 47·83 per cent. However, this is by no means incumbent upon me, but upon Prof. Maly. The assumption of "a very volatile bromide of carbon" cannot satisfy the demand for explanation,—much less can the proposition that an accurate determination of the quantity of carbon was not essential to the ascertaining of the composition of the bromine product. On the contrary, it must be maintained that such results and corollaries are directly opposed to the principles of chemical science, and slap the endeavour for final accuracy rudely upon the face.

31. We have seen above how Prof. Maly believed every green product of the metamorphosis of the colouring matter of gallstones to be "biliverdin." In the same manner he assumed every blue product to be a result of oxidation, and identical with the blue product which forms transiently during the reaction of bilirubin with nitric containing nitrous acid. But the blue product which is obtained with bromine is now transmuted into a product of substitution, and there is no reason to believe that the blue product obtained by means of nitrous acid is a product of oxidation. Indeed it is impossible to predict what it is. Pure nitrous acid forms no blue product with bilirubin. It seems that the presence of alcohol is necessary for the production of a blue body. According to my experiments, nitrous acid, when brought in contact with bilirubin, produces a violent reaction, which, when the apparatus is not cooled down, causes the bilirubin to take fire and burn like glowing charcoal. When the apparatus is carefully cooled down the reaction furnishes a new product, which has the same weight as the bilirubin employed. From this it follows, first, that the formula which Prof. Maly has given for his "cholotelline" is improbable, and that the diminution of the carbon in this reaction which Prof. Maly observed—but left out of consideration or explained away—is much more probable than the alleged oxidation without any loss of carbon, particularly as the nitrogen in the product is the same quantity as that which was present in the bilirubin employed. The three silver compounds of cholotelline, in which the silver rose in quantity from the first to the third, of which, however, only the second one furnished an acceptable theory (*Vienna Acad. Rep.*, vol. lix,, p. 605), are analogous to the zinc compounds of hydro-bilirubin, in which the zinc rose from 14·6 to above 37 per cent (*Liebig's Ann.*, clxiii., 86). Such proceedings must necessarily lead to end and limit of even the plausible in animal chemistry.

32. The observation of the influence of sodium amalgam upon bilirubin, which led Prof. Maly to the discovery of the so-called hydro-bilirubin, would have been an interesting progress in our knowledge concerning bilirubin. But as the author starts from erroneous views regarding the composition and molecular weight of bilirubin, his conclusions regarding his product and its composition, and regarding the formula of the change, are necessarily erroneous. In my letter to Prof. Maly, previously quoted, I wrote to him on this experiment:—"I have repeated successfully your experiment on the reduction of bilirubin, and find that the reaction is completed in half an hour. However, I have also treated bilirubin during some days with sodium-amalgam, just as you prescribe, and the result did not differ from that obtained after half an hour. The product seems to me to be hydrogenised biliverdin, $C_8H_{11}NO_2$."

33. The announcement at the head of this article on hydro-bilirubin, of the transformation of bilirubin into the colouring matter of urine, caused me to read it with expectations which were speedily disappointed when the absolute "urine-colouring matter" became limited to Jaffé's urobilin. I thereupon made many experiments, which I have described in my paper (in the *Journ. Chem. Soc.*, May, 1875), and which, without exception, negative the alleged metamorphosis. On this point I wrote to Prof. Maly:—"I have now compared the products (of the reduction of bilirubin) with all urinary colouring matters with which I am acquainted, and with Jaffé's product, which I have produced for the purpose, but have not discovered any identity. Urochrome and uroerythrine are quite different as regards solubility and chemical properties; uroxanthine, which it is now the fashion to call 'indican,' also. The products of the cleavage of urochrome—namely, uromelanine, uropittine, and omicholine—also. These products can be easily obtained from urochrome by acids; but your hydro-bilirubin yields nothing of the kind, and is not much changed by boiling with hydrochloric acid. Jaffé's urobiline has never been isolated, never been analysed. According to my comparison the mass is a mixture of urochrome, uroerythrine, with a little omicholine already separated. The process (of Jaffé) is not inviting, and the result, in any case, a complicated tincture. I am therefore unable to adopt your conception of the metamorphosis of the colouring matter of bile, into *the* or *a* colouring matter of the urine, in even a single particular." The statement of my experimental proof is contained in the above-quoted paper, of which I subjoin a copy for reference at the Academy's pleasure.

34. In his fourth paper (*Vienna Acad. Rep.*, vol. lxx. 1874) on biliverdin, Prof. Maly relates how he, "already earlier and independently of that Thudichum," had arrived at the formula $C_{16}H_{18}N_2O_4$. However, I had only arrived at half that formula, namely, $C_8H_9NO_2$; but this difference is unimportant. It is quite true that I arrived at this formula independently of Prof. Maly, but I have also a priority with reference to it, which does not appear quite clearly in Prof. Maly's representation. For my research on biliverdin was communicated to the Royal Society already on November 14th, 1867, and published in abstract in the *Proceedings* of that Society, vol. xvi., p. 217. The relative research of Prof. Maly, on the other hand, was communicated to the Academy of Vienna only on February 6th, 1868.

35. In the paper No. IV. just alluded to, concerning biliverdin, Prof. Maly communicates two further elementary analyses of biliverdin, and, as now his results exactly correspond with mine from the year 1867, he is satisfied that the composition of this body can now be considered as definitely established. This time the biliverdin did not contain any ash, and was made according to the orthodox method (of Heintz), with soda and air. There still figures the biliverdin made by means of chloroform and glacial acetic acid, but it cannot easily be precipitated by water. A new green matter, obtained by mono-chloracetic acid from bilirubin, also makes its first appearance. The metamorphosis each time yields less "biliverdin" than the weight of the employed bilirubin, but was obliged in each case to support the theory without analysis.

36. But now comes the buttress of Prof. Maly's theory, according to which biliverdin is bilirubin plus oxygen only,

$C_{16}H_{18}N_2O_3 + O - C_{16}H_{18}N_2O_4$. Bilirubin is transformed into biliverdin, according to the orthodox method, with soda and air, and the product weighed; 0·4558 grm. bilirubin yields actually 0·4458 grm. biliverdin, both dried at 110°. A loss was therefore sustained. There was no guarantee that the biliverdin did not yet contain bilirubin. But the hypothesis demanded a greater weight of biliverdin than was that of the bilirubin employed. In consequence the filtrates were now evaporated, and what they lost by ignition was scored as biliverdin. Even the washing water is put into requisition, and compelled by means of a process termed "ocular measurement" (*augenmessung*) to supply more than half of the desired increase. Thus by hook and crook Prof. Maly succeeds to calculate an increase of 4·3 parts upon 100 of bilirubin, whereas his hypothesis demands an increase of 5·6 parts. "This," says Prof. Maly, "agrees as accurately as can be demanded under such circumstances."

37. As often as the experiments agree very badly with the hypotheses of Prof. Maly, and prove rather the contrary than the hypothesis, he consoles himself with the expression that the result was as good as could be demanded under the circumstances, Thus again, in his first synthetical bromination experiment, paper V., he finds an addition of only 2·74 atoms of bromine to his new bilirubin, $C_{32}H_{36}N_4O_6$, but observes—"This accorded so far with the increase by 3 atoms of bromine which were demanded by calculation and supported by experiment, as could be demanded in determinations of this kind."

38. But the very next synthesis yields 3·1 atoms of Br; the experiment could therefore be made in a more accurate manner than could previously be demanded. But this experiment also has no value at all. Bilirubin, treated with bromine in excess, yields, as I have proved, always dibromo-bilirubin, $C_9H_7Br_2NO_2$, in which N : Br = 1 : 2. In Maly's supposed molecule N : Br = 4 : 3. Consequently if my product were quadrupled, in order to let it contain 4N, it would contain 8Br,—say 8 atoms of bromine. In any case, therefore, Maly would only have introduced 3 atoms of bromine out of 8 which can be introduced. But this high formula is so entirely negatived by my compounds of bilirubin wilth silver, calcium, barium, lead, zinc, and others, that it cannot come into consideration. The formulæ of bilirubin and of its compounds, as ascertained by me, are—

Crystallised bilirubin ..	$C_9H_9NO_2$
Neutral silver salt ..	$C_9H_8AgNO_2 + H_2O$

(analogous to silver hippurate, which, according to Liebig, contains a molecule of water).

Basic silver salt	$C_9H_7Ag_2NO_2$
Neutral barium salt ..	$C_{18}H_{16}BaN_2O_4 + 2H_2O$
Half-acid ditto	$C_{18}H_{16}BaN_2O_4 + C_9H_9NO_2 + 2H_2O$
Neutral calcium salt ..	$C_{18}H_{16}CaN_2O_4 + 2H_2O$
Half-acid ditto	$C_{18}H_{16}CaN_2O_4 + C_9H_9NO_2 + 2H_2O$
Half-acid zinc salt.. ..	$C_{18}H_{16}ZnN_2O_4 + C_9H_9NO_2 + 2H_2O$
Basic lead salt	$C_9H_7PbNO_2$.

To this series the bodies described above as obtained by means of bromine, hydrobromic and sulphuric acid, are attaching themselves quite naturally—

Dibromo-bilirubin	$C_9H_7Br_2NO_2$
Hydrobromo-bilirubide ..	C_9H_8BrNO
Hydrobromo-bilirubide-bilirubin	$C_9H_8BrNO + C_9H_9NO_2$
Cholothalline	$C_9H_{11}NO_3$.

39. It is impossible here to point out all the irrelevant and erroneous detail with which Prof. Maly surrounds his faulty observations. Only some points I must allude to in proof of this statement. Thus the brominated product is said to not admit of drying at a temperature above 30° to 40°, but had to be dried in an exsiccator, because it lost HBr constantly at a temperature of 100°. But my product is perfectly stable at 100° and above. The lower products are also quite stable on drying at 100° in an air-current. I therefore cannot doubt but that Maly's product, when it came to be analysed, did yet contain hydrobromic acid. At all events it is to be regretted that he did not even determine the period at which his product ceased to evolve HBr at 100° and became stable. He was as timid when drying his preparation as he was when brominating it, and for this reason he did not attain any definite point of reaction in either process.

40. I conclude my letter to the Imperial Academy with the expression of the deepest regret concerning the circumstances which have compelled me to write it. I should not be able nor dare to molest the Academy a second time with this matter, and I therefore pray the Academy to excuse the length and serious tone of this letter, with the importance which the matter has for me, for science, and for the maintenance of the ethical rules which govern the intercourse of cultivators of science. I hope that the Academy will give to my letter no less publicity than it has given to the papers which have called it forth.

11, Pembroke Gardens, Kensington, W.,
February 24, 1876.

ON THE NEW RAYS OF CALCIUM.

A Letter From Mr. Lockyer to M. Dumas.

I am pretty far advanced in mapping out the solar spectrum on a scale quadruple that of Angström, and I have commenced with the region of which M. Cornu has lately published an admirable chart. My system, as I believe I have already informed you, is to determine the elements of the sun by photographing on the same plate the spectrum of the sun and the spectra of the different chemical elements. I have already done this with a great number of elements, and under varied conditions as regards pressure. One of the most important circumstances is that to which I am about to call your attention.

If we dissociate, for instance, the chloride of calcium to a slight degree, we obtain a ray of calcium—that which is in the blue, and an almost complete spectrum of undissociated chloride of calcium. In proportion as the dissociation of the chloride advances, the ray in the blue, which is the true calcium ray, becomes more brilliant, and the spectrum of the chloride gradually disappears. I admit that the experiment has been made at a low temperature. But if we employ an electric arc we obtain, in the blue, this line exceedingly well developed, and at the same time, in the violet, two new lines, which occupy the place of the two lines H in the spectrum of the sun. The remarkable point is that the ray in the blue is much broader and more brilliant than the two rays in the violet when we employ an electric arc, *e.g.*, produced by 30 Grove's elements; whilst in the sun the blue ray is very feebly represented, and the two violet rays are the broadest in the entire solar spectrum. Between the temperature which we produce and that of the sun there is then a difference which is, as regards the spectrum of calcium, what the varying temperatures which we can obtain are for the chloride of calcium.

To verify this fact I have recently carried out a series of experiments upon calcium, employing at first a small battery and a small coil, and afterwards a large battery and a larger coil, and to avoid all doubts I photographed the results. I found that with the small coil I was able to obtain a photograph which only contained the ray in the blue, without any trace of the ray in the violet; and with the largest battery and the largest coil I obtained a photograph containing the rays of the violet without any trace of the ray in the blue, and that by varying the surface of the battery I was able to get a spectrum resembling the absorption-spectrum of calcium in the sun.

These results agree so completely with those of the dissociation of a salt of calcium that I have asked myself the question if we have not here before us a dissociation of

calcium itself. Naturally we are unable to determine, for the present, whether we have a lower molecular group of calcium, or whether the calcium itself is a compound of two distinct sub-elements, if the expression may be used. It seems that we can only undertake to solve this question by photographing the rays of calcium (H_1H_2) in different stars. If we find that they present always the same relative breadth and intensity there will be a strong presumption that we have met with a decomposition of calcium, or, in other terms, we shall have shown that a spectrum of rays is a spectrum due to different orders of molecular grouping. If, on the other hand, we find that these lines vary in breadth and in intensity, it will be difficult to explain this phenomenon except we admit that calcium, instead of being an element, is really composed of two substances.

I must add that Prof. Stokes—whilst admitting that we have here a very convenient method for determining the power of dissociation existing in the sun, since we may find the extent of that power by the number of square inches of battery surface—does not believe that the evidence in favour of the dissociation of calcium is quite complete; and he believes it possible that with an increase of temperature the more refrangible lines increase in brilliance at the cost of the less refrangible, so that, if the quantity decreases gradually, we may obtain the results above described. I have, however, pointed out to him that this law does not hold good in other cases: for instance, with hydrogen an increase of temperature does not give a greater intensity to the red line C, and in case of sodium at the temperature of the sun we know that the absorption of the yellow line of sodium is more intense than that of any of the rays.—*Comptes Rendus.*

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 114.)

The ammonia remains dissolved in the water only under the pressure at which it was saturated, and escapes in proportion as such pressure is diminished; at the same time the liquid is cooled in a corresponding degree, as during the evaporation of pure liquid ammonia. Mort and Nicolle produce this decrease of pressure by means of the air-pump. The ammonia removed is condensed by the return stroke of the piston and along with a corresponding amount of the diluted liquid simultaneously withdrawn from the evaporator is forced through a cooler where re-absorption takes place. This arrangement requires less motive power than a pure mechanical condensation. It is to be expected that this ammonia machine should be more efficient than the ether machine, but its performance falls short of that of Carré's machine. More exact accounts are hitherto not to be had. The machine works at lower pressure than the ether machine, and like this must be carefully protected against the influx of air. The danger of explosion is removed from the machine itself and transferred to the boiler of the engine.

About the end of 1870 Mort and Nicolle have patented a new ammonia machine of which the only description in our hands is the English specification. It is described as the "low-pressure ice machine," and agrees in principle with Carré's machine, the air-pump being omitted. It differs, however, from the latter machine in as far as not liquid anhydrous ammonia, but a highly concentrated aqueous ammonia is produced and evaporated. This of course requires a much lower boiler pressure, the maximum tension being about 2 atmospheres at a steam heat of 107° C. The evaporation of course produces a much smaller reduction of temperature. The arrangement is such that the ammoniacal liquid streaming from above into the ice generator, and flowing slowly over horizontal depressions gradually loses its ammonia, and arriving at the bottom in a very reduced state of concentration is drawn out by means of a pump, and in an especial vessel re-absorbs the ammonia which has been expelled by the heat. The liquid restored to its original degree of concentration is pumped back into the ice generator. The liquid escaping below from the kettle, and which is little more than water, serves as in Carré's machine for the re-absorption of the ammonia evaporating from the ice generator, and is driven back into the boiler by a second pump. It must be mentioned as a speciality that the ammonia evaporating in the boiler passes first into a cylinder with a piston, and furnishes the power for working the pumps, whereupon the absorption takes place.

Air-pump Sulphuric Acid Machine, by Edm. Carré, of Moislains.—We have still to mention a peculiar ice machine invented by the brother of the above-mentioned F. Carré, and also belonging to the class of absorption machines. Hitherto the idea has only been carried into practical execution on the small scale for domestic use. It was shown for the first time at Paris, in 1867, and has since been exhibited at Vienna. In principle it depends upon the cooling and freezing of water by its own evaporation in a vacuum—the well-known experiment of Leslie. E. Carré arranges his apparatus as follows:—A cylindrical vessel consisting of lead alloyed with 5 per cent of antimony is half filled with concentrated sulphuric acid which can be kept in motion by means of a stirrer acting from without. With the upper empty part of the vessel is connected on the one hand an air-pump, and on the other an ascending tube fitted with a cock and slightly bent, so that a flask filled with water may be placed in its end, and an elastic band serving for a lute. All the joints are very carefully adapted so as to prevent all access of air. When the air-pump is set in action the entire air is removed from the connected apparatus, the water evaporates and is absorbed by the sulphuric acid. After some time a crust of ice is formed in the flask, which increases more and more till the whole, which fills about half the flask, is frozen. The author succeeded in forming 340 grms. of ice in forty-five minutes, 60 grms. of water having evaporated. The duration of the operation increases when the sulphuric acid grows hot and becomes diluted. By the use of 1½ litres of concentrated sulphuric acid, 12 flasks of ice, each amounting to 340 grms., can be obtained. The last flask required two hours in freezing, and 75 grms. of water were absorbed. The sulphuric acid had then taken up one-third of its weight of water, and its sp. gr. was 1·6. The cost of a flask of ice was 10 pfennige (about one penny, English) if the sulphuric acid is not put to any further use. In this form the apparatus is exclusively destined for the *Carafe frappée, i.e.*, to cool drinking water by means of ice. The writer does not think the machine fit for domestic use, since the smallest entrance of air renders it useless, and satisfactory connection-materials are not easily met with. Concentrated sulphuric acid also is an objectionable article in the household.*

(To be continued.)

* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzehends."

ON CERTAIN CIRCUMSTANCES WHICH AFFECT THE PURITY OF WATER SUPPLIED FOR DOMESTIC PURPOSES.

By M. M. PATTISON MUIR, F.R.S.E.,
Assistant Lecturer on Chemistry, Owens College.

(Concluded from p. 146.)

III. *Influence of House Cisterns upon the Water Supply.*—There appears to be a somewhat wide-spread feeling

* *Bad. Gewerbs.*, 1868, 153. *Comptes Rendus*, lxiv., 897. *Dingler Polyt. Journ.*, 77 and 417.

against the use of cisterns in dwelling-houses, which is, I suppose, chiefly due to the fact that the waste pipe from the cistern is generally in connection with the soil pipe which carries off the drainage of the house.

The hurtful sewer gases may thus readily find their way into the cistern, and so contaminate the water therein stored. On the other hand, however, it may be urged that inasmuch as the water in cisterns is frequently changed there is no great probability that the water actually used for domestic purposes will be, at any rate largely, contaminated by sewer gas. I have attempted to obtain some definite measurements of the amount of contamination present in cistern waters, in so far as this may be estimated by the chemical processes at present in our possession.

The method which I have adopted consists in measuring the amount of free and of albuminoid ammonia, and the amount of nitrogen existing as nitrates and nitrites; from these data we may deduce, at any rate comparative measurements, of the purity of various waters.

In order to prove conclusively, for my own satisfaction, that if sewer gases be absorbed by water their presence will be indicated by a marked increase in the quantities of ammonia, free and albuminoid, obtained from that water on analysis, I carried out the following preliminary experiment:—

A quantity of distilled water, free from ammonia, was placed in a porcelain basin, which was covered with porous paper, and suspended at a short distance above the liquid in a sewer which received the refuse from a very large area, chiefly occupied by dwelling-houses, in Glasgow. After ninety-six hours the free and albuminoid ammonia were estimated with the following results:—

Free ammonia = 0·60 mgm. per litre = parts per million.
Albuminoid ,, = 0·54 ,, ,, ,, ,,

It is thus evident that the absorption of sewer gases by water causes a marked increase in the quantities of ammonia obtained on analysis.

The method adopted for the estimation of ammonia was the well known one of Wanklyn and Chapman: the method for the estimation of nitrates was that described by Thorpe in the *Journal of the Chemical Society* for June, 1873. This method consists in evaporating the water, along with a fragment of ignited quicklime, to a small bulk, and then evolving the nitrogen, as ammonia, by the action of zinc, coated with a deposit of spongy copper, at a boiling heat.

In selecting the waters for examination I endeavoured, as far as possible, to obtain typical samples; in this endeavour I was greatly aided by the kindness of Mr. Macleod, the Sanitary Inspector for Glasgow, who obtained for me samples of waters from various houses situated in the lower parts of the town.

The results are calculated as follows:—

a wooden cistern closed at the top. No. 8. From cistern situated just under the slates in a house in a lower locality than any of the preceding. No. 9. From cistern over water-closet in a dwelling-house. No. 10. From cistern similar to above. No. 11. From the cistern same as No. 9. but after stirring up the muddy deposit at the bottom. No. 12. From cistern near the slates in a house where there had been two cases of fever and where the water was complained of.

Omitting for the present No. 11, it is found that No. 2 sample yields the highest number for free and for albuminoid ammonia, also for nitrates. Now this sample was taken from the cistern of a house in which the pipes have been recently entirely renewed, and in which the pipe leading from the water-closet to the main drain is thoroughly ventilated. The water in this cistern is, however, very rarely used; for all domestic purposes a supply is obtained directly from the main; it would therefore appear that sewer gases are slowly absorbed by water stored in such a cistern. That this absorptive action must take place slowly is evident if we look at the results obtained from the other waters. Although many of these waters were taken from badly situated cisterns, yet in none of them can the influence of sewer gases be distinctly traced. We must therefore conclude that the rapidity with which the water in the cistern has been changed has prevented any appreciable action of the gases upon these waters. There are, it is true, slight variations in the numbers obtained, but in no case do we find a notable increase as compared with water from the main pipe.

The amount of ammonia, &c., obtained from a sample of the slimy matter found at the bottom of one of the cisterns (No. 11) indicates that a great part of the ammonium salts, &c., is concentrated therein; this matter may therefore perhaps exercise a certain beneficial effect upon the water.

The general conclusions which I would draw from these results are:—

(1.) That sewer gases are absorbed by water, but that this absorption takes place slowly.

(2.) That in ordinary house cisterns the water is not contaminated to any great extent with sewer gases, probably because of the short time during which this water is allowed to remain in the cistern, and also perhaps because of the deposition of part of the impurities in the muddy substance which settles at the bottom of the cistern.

The general problem of the influence of the means of supply upon potable waters is a very wide one. I offer these measurements as a contribution towards its solution.

TABLE H.

Ammonia and Nitrates found in Various Samples of Water.

Mgms. per Litre = Parts per Million.

	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.
Free ammonia	0·005	0·085	0·023	—	0·015	0·015	0·010	0·035	0·015	0·075	0·200	0·045
Albuminoid ammonia	0·092	0·120	0·080	0·082	0·090	0·080	0·085	0·085	0·070	0·065	0·370	0·090
Nitrogen as nitrates and nitrites	0·309	0·463	—	0·321	0·360	0·200	0·258	—	0·284	0·306	0·414	—

These samples were obtained from the following situations:—No. 1. From main pipe. No. 2. From cistern in same house, little used. No. 3. From cistern in house similar to No. 2, but water generally used. No. 4. From pipe leading directly out of the bottom of cistern in well situated dwelling-house. No. 5. From cistern in smaller dwelling-house. No. 6. From small cistern supplying part of a dwelling-house only. No. 7. From public well supplied by Loch Katrine water contained in

CORRESPONDENCE.

TREATMENT OF ANTHRACEN OIL.

To the Editor of the Chemical News.

SIR,—In reply to the letter of Mr. William W. Staveley, reviewing my article on this subject in CHEMICAL NEWS (vol. xxxiii., p. 99), as I have now made use of the so-

called residual method for some time, I may perhaps be permitted to speak from experience as to the practical mode of working it.

Mr. Staveley has very correctly described the result of my first attempt to work the process on a large scale. I obtained a black greasy mass, full of pitch, and sufficiently uninviting to the eye. Having pressed a small quantity and submitted it to analysis, the result was so satisfactory that I was encouraged to make another trial with a second quantity of oil. For this purpose I selected a perfectly clean still, as I judged that the black colour of the deposit on the first trial was mainly due to the fact that the condensation had been conducted in a still previously used for tar distillations, and containing a quantity of pitch at the bottom. I now obtained a cake perhaps a shade darker in colour than is usually procured from the first crystallisation, but leaving little to complain of on that score.

In order to ensure success in this mode of treatment, therefore, care should be taken in the outset to commence with a clean still, and the condensation should not be pushed too far. The crude anthracen obtained in this way is difficult to filter, but not more so than when the oil is distilled, and by proper means the filtration may be much facilitated.

I was under the impression, when I stated that the solid residue contained 17 per cent anthracen, it would be fully understood by those to whom my article was addressed that the crude anthracen had previously been deprived, by filtration and pressure, of the oily matters associated with it; and I believe Mr. Staveley, although he finds fault with the obscurity of my description, perfectly comprehends my meaning. I am pleased to observe that Mr. Staveley's results on a small scale, as to quality and quantity of anthracen cake produced, are to a certain extent confirmatory of my own; and, should time permit, I hope hereafter to give further and more exact details of the process and its results.—I am, &c.,

A. McDonald Graham.

Turnchapel, Plymouth,
April 6, 1876.

VANADIUM FOR ANILINE-BLACK.

To the Editor of the Chemical News.

Sir,—In the Chemical News (vol. xxxiii., p. 140), in your summary of the contents of *Reimann's Farber Zeitung* (No. 11), you quote a letter from the French correspondent of that Journal in Rouen, in which he says that aniline-blacks with vanadium are there in use on a large scale. This is doubtless true. I should not have troubled you with this letter if your extract had ended with this statement, but you continue to quote some remarks made by the Editor of that Journal on this subject, in which he says "that it must be confessed that the colourists of Rouen produce far more novelties than their colleagues in all the rest of the world," and with a spirit of self-depreciation which is eminently characteristic of the English you continue—"If Germany makes such a confession, what must England say?"

Permit me to say that in this matter of the development of the use of "vanadium" for dyeing and printing cotton, woollen, and silk fabrics aniline-black, that neither French chemist nor French colourist has had anything to do with it.

The first-published suggestion of the use of vanadium for aniline-blacks was made by the late John Lightfoot, of Accrington—an Englishman: it was worked out by Robt. Pinkney, Esq., of London—another Englishman. Some of the best calico-printers in Lancashire have used vanadium instead of copper, in printing aniline-black, for three or four years past; and the various salts of vanadium, useful for this purpose, have only as yet been prepared on a commercial scale by myself.—I am, &c.,

Saml. Mellor.

Magnesium Works, Patricroft.

[We quote the following letter from the *Textile Colourist*:—

"Sir,—Having read your article on this most curious and interesting metal, in the March number of the *Textile Colourist*, with much interest, and in view of the most important part which it is destined to play, not only in medicines and photography, but eminently in the art of dyeing and printing silk, woollen, and cotton fabrics, a few words in reference to its recent discovery in greater abundance, and its application to calico-printing, may not be without interest to your subscribers, at the same time that it records historically the progress hitherto attained.

"We are indebted to Prof. Roscoe for the discovery of vanadium in the residues left after the extraction of cobalt by the acid process as lately conducted at the works, Mottram St. Andrew's, Cheshire.

"Availing himself of the use of our furnaces and utensils which were larger than the apparatus, &c., then at his command in the old Owens College, Quay Street, Manchester, a quantity of these residues were worked up early in the year 1867, and sufficient vanadic acid was made to enable him to conduct his exhaustive researches, and to determine once and for all the atomic weight and the true constituents of the various compounds of vanadium.

"All the vanadic acid made having been used up by Dr. Roscoe in these original investigations early in the spring of the year 1870, a larger batch of the residues was put into work, and about 100 ozs. of vanadic acid was produced—the largest amount of vanadic acid there had been in the world up to that date. From this store of 100 ozs. Prof. Roscoe very liberally placed at our disposal about 30 ozs., the rest being required for his further experiments. In December of the same year it was sent up to London, to the eminent metallurgical firm of Johnson, Matthey, and Co., for sale, and it may be regarded as an evidence of the earnestness of purpose with which the late Mr. John Lightfoot, of Accrington, conducted his experiments, and watched the advent of any substance calculated to advance his discovery of the best method of working aniline-black; for there is little doubt that almost immediately afterwards he must have procured some vanadium oxide from this stock, for whilst in his original specification for printing and dyeing fabrics and yarns, and which is dated October 12th, 1870, vanadium is not mentioned, yet in the completed specification of his patent, dated April 12th, 1871, only a little over three months after the first lot of vanadium oxide was offered for sale, he states the fact that other metals and their compounds than copper can be used to form aniline-black, and amongst the rest he enumerates the oxide of vanadium; and in a small work by him on aniline-black, published May 1st, 1871, he records some interesting experiments made with various metals, and in it he states that the *best black* is obtained by the use of vanadium.

"It was without doubt because of Mr. John Lightfoot's ignorance of the marvellous power possessed by the various salts of vanadium when brought into contact with a mixture of aniline hydrochlorate, and the chlorates of sodium and potassium, to form aniline-black, that he did not introduce it into the original specification of his patent, but between the dates October 12th, 1870, and April 12th, 1871, he acquired this information when acting under the advice of his patent agent, who would inform him that the completed specification of his patent could only be an amplification of his original specification, but that no new matter could legally be introduced into it. Although he mentions that vanadium could be used, he does not claim its use in his patent.

"The high price of vanadium oxide—then 60s. per oz.—and its exceeding rarity were reasons why he would decline to apply specially for a patent for its use in the formation of aniline-black; indeed it is on record that about this time he said that by far the best and most powerful agent to use in order to produce aniline-black was vanadium, but that there was not sufficient vanadium in the world to supply the wants of one firm of calico-

printers, much less the requirements of the whole trade.

"It was about this date that Mr. Robert Pinkney, of the firm of Blackwood and Co., London, requiring a substitute for copper for their marking-ink,—independent of and absolutely in ignorance that the late Mr. John Lightfoot was at the same moment engaged experimenting on the same substance, for the same purpose,—made some original investigations upon the use of the salts of vanadium in the formation of a permanent black. He found that only a few grains of the chloride of vanadium—say from 7 to 12 grains for 1 gallon of liquid, consisting of hydrochlorate of aniline and chlorate of soda—were sufficient for the formation of aniline-black; and, acting upon the belief that if vanadium was required it would be forthcoming, he applied for a patent for the use of the salts of vanadium in the formation of aniline-black, October 16th, 1871, and since then hundreds of thousands of bottles of marking-ink, called "Jetoline," have been sold by this firm, in all of which vanadium has been used.

"At the time of the removal of the Owens College from its old premises, Quay Street, to its present palatial buildings, Dr. Roscoe very generously gave me all his stock of residues from the Mottram Mine, amounting to about 1 ton, and at the same time earnestly suggested that every effort should be made to obtain supplies from some other source, for, he argued, there was the requisite furnaces, utensils, and knowledge required to prepare the salts of vanadium, and if once a quantity of this substance, with its wonderful and quite unique properties, existed with reasonable probability of further supplies, many uses for it must sooner or later be developed.

"This advice has been adopted, and in course of time control over the only known deposit of vanadium in the world has been obtained.

"The results have abundantly vindicated the soundness of Dr. Roscoe's advice, and the number of applications opening out for this most marvellous substance has demonstrated the immense value of original researches, even upon substances which may seem to be amongst the rarest in nature.

"Unfortunately the amount of vanadium found in the ore obtained from the deposit named is only a few ounces per ton, but as the properties possessed by the compounds of this metal are of the most extraordinary and valuable character, and as the smallest quantity of it performs a great amount of work, it may possibly suffice for present wants until other and richer deposits are found. Meanwhile, the many and important uses opening out for the salts of this metal in science, manufacture, and arts, mark another step onward in that ultimate victory of man over nature, which it is his privilege and birthright to assume,

"Thanks to chemistry for having enabled us to score this additional victory.

"S. M.

"Magnesium Works, Patricroft."]

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances, de l'Academie des Sciences. No. 13, March 27, 1876.

Remark on the Recent Communication of Mr. Lockyer on the New Rays of Calcium.—M. C. Ste.-Claire Deville.—The curious experiment described by Mr. Lockyer in his letter to M. Dumas on the property of calcium in presenting two distinct systems of rays according to the energy of the batteries applied has a profound interest for mineralogists. In a series of lectures which I delivered at the Collége de France, and of which I gave a summary (*Comptes Rendus*, liv., 782, 880, 949), I showed that the electro-positive elements of natural compounds do not enter indifferently into such compounds, but that some of these bodies belong in a manner virtually to a group of minerals marked out both atomically and crystallographically, and are, on the contrary, always strangers to other even closely approximating groups; but I showed that there exist most frequently between two neighbouring groups two minerals belonging respectively to each of the two groups, and characterised by one and the same basic element, playing this double part, and to which I gave the name of limitary or axial body. But of all the simple bodies calcium most frequently plays this strange part. Is this remarkable property in calcium of belonging at once to different types connected with its twofold behaviour under the influence of dissociating agents? Will the same hold good with titanium, iron, &c., which seem also to play a Protean part in the mineral kingdom?

Report on a Memoir by M. E. Bourgoin, presented to the Academy, and entitled "Researches in the Succinic Series."—MM. Cahours and Berthelot.—M. Bourgoin has studied the conditions under which succinic acid may be directly converted into malic acid. The examination of these conditions has led to the discovery of two new acids, the oxymaleic and dioxymaleic.

Study of Stratified Light.—M. Neyreneuff.—Judging from his experiments on the action of electricity upon flames and gases, the author admits that there exist in a Geissler's tube traversed by discharges two forces which tend to impress a vibratory movement upon the gaseous mass within. He has found in studying the combustion of detonating mixtures the most important characteristics of electric stratification. The two series of phenomena may therefore be assimilated as regards their producing cause.

Photo-micrographic Researches on the Transformation of Collodion in Photographic Operations.—M. J. Girard.—The microscopic examination of collodion renders it practicable to distinguish the nature of the texture of the stratum, and to follow the reactions which take place in the production of the photographic image. When it is of good quality the layer is translucent, colourless, the cotton being perfectly dissolved. Among the most frequent modifications may be mentioned—First. Old collodion which still gives good impressions, but less rapidly than is to be desired; it contains liquid globules of modified ether. If too alcoholic it has the appearance of cellular tissue, and if water is present the fibrillæ of cotton become apparent in the form of amorphous flocks. Second. Collodion which is too thick; it is intense, but without speed of action, having the appearance of a wavy cellulo-vascular tissue. This want of regularity in the stratum affects the distinctness of the impression which it ought to receive.

Communications at a Distance by means of Water Courses.—M. Bourbouze.—This paper was deposited with the Academy in a sealed packet on November 28, 1870, and was now opened and read at the desire of the author. The experiments described show that it is possible to telegraph to considerable distances without wires; that telluric currents may be substituted for those of the batteries generally employed, provided the immersed surfaces are duly varied, and that such currents may decompose the solutions of metallic salts.

Exchanges of Ammonia between Natural Waters and the Atmosphere.—Th. Schlœsing.—This paper is not suitable for abstraction.

Sources of Carbonic Oxide: New Method of Preparing Highly Concentrated Formic Acid.—Mix formiate of soda with oxalic acid, both dry and in powder. On heating in the water-bath one obtains almost the theoretical quantity of an acid containing 99 per cent of actual formic acid.

MISCELLANEOUS.

The Radiometer.—Current literature, the faithful reflex of popular opinion, proves that the general interest in Mr. Crookes's remarkable discoveries concerning repulsion by radiation and the mechanical action of light continues unabated, notwithstanding the unusual degree of publicity accorded the successive researches of the discoverer, and the large number of recruits which have been thereby attracted to aid in the subjugation of the new territory and report to the less interested bystanders what they have seen. Thus in the last issue of the *Quarterly Journal of Science* will be found a report *in extenso*, with illustrations, of the lecture delivered by Mr. Crookes at the Royal Institution, already briefly summarised by us under the heading of "Weighing a Beam of Light." In *Fraser's Magazine*, also, there is an appreciative article on Mr. Crookes's discoveries, written in a fairly comprehensive and scientific, though essentially popular, manner. Indeed almost every periodical addressed to cultivated readers has had something to say upon the subject at one time or another; and this is true of France, Germany, and the States, no less than of our own country. It is not often that any discovery gives rise to a mass of criticism so large and varied in character as in the present instance. In the hands of a philosopher such as Herbert Spencer, these criticisms would afford fine illustrations of different kinds of bias, and of the errors resulting from each. Mr. Crookes in the hands of his critics is somewhat similarly placed to the member elect in some borough where party feeling runs high. His "friends" would push him ahead faster than he is prepared to go, whilst the other side would metaphorically "bonnet" him and hustle him out of sight with as little ceremony. According to the *Athenæum*, Professor Osborne Reynolds in a recent lecture, not merely ignored Mr. Crookes's labours, but re-christened the radiometer "Geissler's Light Mill," though the latter is in fact nothing but a Crookes's radiometer manufactured by Geissler, of Bonn. On the other hand, some of Mr. Crookes's friends write as if, before his researches, nothing whatever was known of the influence of radiation on delicately suspended bodies, and so lay the one they would befriend open to the charge of ignorance or *suppressio veri*, though his first paper, read before the Royal Society, is prefaced by a most scrupulously detailed list of his predecessors' researches in the same field, and a full acknowledgement of his obligations where such were due. Again, many of his well-wishers reason as if it were a matter of life and death to Mr. Crookes's fame to maintain that the phenomena discovered by him are due to *light* alone, and that all cause for wonder would cease if it were admitted that *heat* had anything to say to them. We noticed how very careful Mr. Crookes was to avoid committing himself to any theory when lecturing at the Royal Institution, and fully appreciating the intention and importance of this reserve, we found space even in our brief notice of the lecture, to record the fact that Mr. Crookes styled the force neither light nor heat, but a "function of the refrangibility." His views on this point are very clearly set forth in the *Quarterly Journal of Science*.

"The human eye," says Mr. Crookes, "by what we may term a physiological accident, is sensitive to but the central portion of the solar spectrum; the part at the red end possesses in the greatest degree the property of causing the sensation of warmth, and of dilating the mercury in a thermometer, and of doing other things which are conveniently classed among the effects of *heat*; the centre part affects the eye, and is therefore called light; whilst the part at the other end of the spectrum has the greatest energy in producing chemical action. But it must not be forgotten that any ray of the spectrum, from whatever part it is selected, will produce all these physical actions in more or less degree. A ray in the orange, for instance, if concentrated on the bulb of a thermometer, will cause the mercury to dilate, and thus show the presence of *heat*; if concentrated on my hand I feel *warmth*; if I throw it on the face of a thermo-pile it will produce a current of electricity; if I throw it upon a sensitive photographic plate it will produce chemical action; and if I throw it upon a radiometer it will produce motion. What, then, am I to call this ray? Is it light, heat, electricity, chemical action, or motion? It is neither. All these actions are inseparable attributes of the ray of that particular wave-length, and are not evidences of separate identities. I can no more split that ray up into five or six different rays, each having different properties, than I can split up the element iron, for instance, into other elements, one possessing the specific gravity of iron, another its magnetic properties, a third its chemical properties, a fourth its conducting power for heat, and so on. A ray of light of a definite refrangibility is one and indivisible, and these different properties of the ray are mere functions of that refrangibility. There is no physical difference between heat and light; so to avoid confusion, I call the total bundle of rays, which come from a candle or the sun, *radiation*."

Perhaps fully one-half of the voluminous correspondence on Mr. Crookes's discoveries would never have seen the light if the writers had been possessed of that small modicum of modesty or self-mistrust necessary to make them doubt whether their own intellectual calibre was such that they knew more of the subject by intuition than another man, a gold medallist of the Royal Society, did after many months' laborious and indisputably skilled research. Had they asked themselves that question, the public would have been spared many folios of turgid truisms, and themselves the shame of advancing theories which had been disproved by experiment perhaps years before. A week or two ago a letter, written evidently in the highest possible spirits, appeared in the columns of a contemporary, announcing that, interesting and important as Mr. Crookes's researches were, his alleged discovery of the mechanical action of light had been anticipated by some forty years. We need hardly remark that if the writer of the letter had read Mr. Crookes's *résumé* of previous investigations, he would have found the experiment referred to duly recorded, though it affects as little the question of priority as Puck's offer to "put a girdle round about the earth in forty minutes" does the originality of the modern system of laying submarine telegraph cables. So long as poor human nature remains what it is, and what it ever has been, it is hopeless to expect that discussions on a new discovery will be conducted without animus and upon merits alone. Lord Brougham, writing in the *Edinburgh Review*, likened Dr. Young's hypothesis of the undulatory theory of light to "the unmanly and unfruitful pleasure of a boyish prurient imagination, or the gratification of a corrupted and depraved appetite." Public opinion no longer admits of such unbridled license in criticism as this, but that the snake though scotched retains his venom fangs, the tone of some criticisms of Mr. Crookes's labours clearly proves. Some allowance should undoubtedly be made for disappointed physicists. As remarked in *Fraser's Magazine*—"The general surprise was not lessened by the fact that the announcement of this mechanical action of light came from an unexpected quarter; for although Mr. Crookes, as the discoverer of thallium and as an original investigator, was well known even outside scientific circles, the public at large would have rather looked for an announcement of this character from one of the more popular exponents of science whom they had delighted to honour." Prof. Huxley has likened the progress of science to that of a nail in the wheel of a coach, since to one sitting on the coach, and regarding the nail alone, the movement appears at times to be retrograde in character, although to one standing afar off each part undoubtedly shares in the general progress of the whole. We may expand the simile, and remark that it is not the big wheels which lead and guide the coach.

Some of our most popular scientific men have to be content with the part of the big wheels, for, to quote Dryden,—

> "They like the hindmost chariot wheels are cursed,
> Still to be near, but never to be the first."

It is nevertheless somewhat unjust to Mr. Crookes to regard his researches in a captious and unfriendly spirit, merely because he happens to be an original and successful investigator.—*Engineering*, *April 7*.

NOTES AND QUERIES.

*** Our Notes and Queries column was opened for the purpose of giving and obtaining information likely to be of use to our readers generally. We cannot undertake to let this column be the means of transmitting merely private information, or such trade notices as should legitimately come in the advertising columns.

Methyl-Aniline Violets.—Can any of your readers kindly inform me where, in this country, methyl-aniline violets, discovered by M. Lauth, and a violet discovered by M. Hauthmann, of Berlin, and referred to by M. Cornil in *Arch. de Physiologie*, is to be procured, or an account of the method of preparing it found?—DELTA.

MEETINGS FOR THE WEEK.

MONDAY, 24th.—Medical, 8.
—— Society of Arts, 8. Cantor Lectures. "Wool Dyeing," by George Jarmain.
TUESDAY, 25th.—Civil Engineers, 8.
—— Royal Institution, 3. "Comparative Geology and former Physical Geographies of India, Australia, and South Africa," by Prof. P. M. Duncan, F.R.S.
—— Anthropological, 8.
WEDNESDAY, 26th.—Society of Arts, 8. "The So-called Deposits of Onyx near Mexico, and their Value as a Decorative Material in this Country," by W. Eassie, C.E., F.L.S., F.G.S. "Sericiculture in Australia," by Mrs. Bladen Neill.
—— London Institution, 12. (Anniversary.)
—— Geological, 8.
THURSDAY, 27th.—Royal, 8.30.
—— Royal Institution, 3. "On Voltaic Electricity," by Prof. Tyndall, D.C.L., LL.D., F.R.S.
—— Royal Society Club, 6.30.
FRIDAY, 28th.—Royal Institution, 9. "Physiology of the Nervous System of Medusæ," by G. J. Romanes.
—— Quekett Microscopical Club, 8.
SATURDAY, 29th.—Royal Institution, 3. "On the Present Relations of Science and Philosophy," by Prof. W. K. Clifford, F.R.S.
—— Physical, 3.
—— Zoological, 1. (Anniversary.)

ERRATA.—In Table III., page 154, col. 2, line 16 from top, *for* "c.c. of cyanide consumed" *read* "c.c. of cyanide consumed when no NH_4Cl was present:—34·8—34·9; mean 34·85." In Table IV., page 154, col. 2, line 33 from top, *for* "c.c. of cyanide consumed" *read* "c.c. of cyanide consumed when no NH_4NO_3 was present:—34·8—34·9; mean 34·85." Page 160, col. 1, line 11 from top, *for* "Mr. W. Jowage" *read* "Mr. W. Gossage."

THE
QUARTERLY JOURNAL OF SCIENCE.

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Now ready No. L., *April*, 1876, price 5s.

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IV. Biological Controversy and its Laws.
V. The Mechanical Action of Light. By the Editor.

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Wanted, a Re-engagement as Chemist with a Manufacturer or Analytical Chemist.—For references re-address X. Y., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

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LECTURE ARRANGEMENTS AFTER EASTER, 1876.

HOUR, THREE O'CLOCK.

PROFESSOR P. M. DUNCAN, F.R.S.—Four Lectures on the Comparative Geology and Former Physical Geographies of India, Australia, and South Africa; on Tuesdays, April 25 to May 16.
PROFESSOR TYNDALL, D.C.L., LL.D., F.R.S.—Seven Lectures, on Voltaic Electricity; on Thursdays, April 27 to June 8.
PROFESSOR W. K. CLIFFORD, F.R.S.—Two Lectures on the Present Relations of Science and Philosophy; on Saturdays, April 29 and May 6.
PROFESSOR W. G. ADAMS, F.R.S.—Three Lectures on some of Wheatstone's Discoveries and Inventions; on Tuesdays, May 23 to June 6.
FREDERICK J. FURNIVALL, Esq.—Two Lectures on Chaucer; on Saturdays, May 13 and 20.
Three Lectures on Saturdays, May 27 to June 10.

Subscription to all the Courses, Two Guineas; to a Single Course, One Guinea or Half-a-Guinea.

The Friday Evening Meetings will be resumed on April 28th, at 8 p.m. Mr. G. J. Romanes will give a Discourse on the Physiology of the Nervous System of Medusæ, 9 p.m. The following Discourses will probably be given by Professor Gladstone, W. Froude, Esq., C. T. Newton, Esq., J. F. Moulton, Esq., Sir J. M. Lubbock, and Professor Tyndall. To these Meetings Members and their Friends only are admitted.

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CHEMICAL WORKS AT WHITECROOK, DALMUIR, NEAR GLASGOW.

To be Sold (under the Direction of the High Court of Justice) by Public Roup, within the Faculty Hall, Saint George's Place, Glasgow, on Wednesday, April 26, 1876, at 2 o'clock in the afternoon.

THE Whitecrook Chemical Works of the British Seaweed Company (Limited), situated upon the Forth and Clyde Canal, with the ground connected therewith, and whole Engines, Machinery, Boilers, Retorts, Pans, Vitriol Chambers, Chimneys, and whole other Movable Plant, and Buildings on the ground, including Apparatus of the most approved construction for the manufacture on a large scale of Sulphuric Acid, Carbonate, Chlorate, Muriate, and Sulphate of Potash, Caustic Soda, Refined Brimstone, Iodine, Bromine, Iodide and Bromide of Potassium, &c. The Works have unusual facilities for water carriage, and are near to the Dalmuir Station of the North British Railway Company, by which there is direct communication to all parts of the United Kingdom. The ground connected with the Works extends to 8 acres and 10 and 7-10th poles (more or less) subject to a feu duty of £149 13s. Entry immediately.

For further particulars apply to H. J. C. F. Woodhouse, Public Accountant, 14, Warwick Court, Holborn, London; to J. N. Cuthbertson, Chemical Broker, 29, Bath Street, Glasgow, Official Liquidators of the British Seaweed Company (Limited); to Bannatynes, Kirkwood, and M'Jannel, Writers, 145, West George Street, Glasgow; to William A. Crump and Son, Solicitors, 10, Philpot Lane, London, E.C.; to Chauntrell, Pollock, and Mason, Solicitors, 63, Lincoln's Inn Fields, London, W.C.; or to Balfour and Paterson, Writers, 138, Hope Street, Glasgow, the latter of whom will exhibit the Titles and Articles of Roup.

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THE CHEMICAL NEWS.

Vol. XXXII. No. 857.

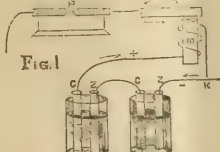
ELECTRICAL PHENOMENA.

The Alleged Etheric Force. Test Experiments as to its Identity with Induced Electricity.

By PROF. EDWIN J. HOUSTON and PROF. ELIHU THOMSON.

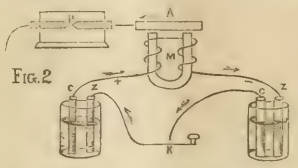
Since the experiments of Mr. Edison are still believed by some to demonstrate the existence of a force hitherto unknown, we submit the following considerations, together with experiments, which we believe to be crucial in establishing the identity of the supposed new force with inverse currents of induced electricity. The alleged necessity for the assumption of the new force being based on its asserted lack of polarity, we propose to show how two opposite phases of the so-called new force may neutralise each other, thus conclusively establishing its polarity.

In order to show that, in Mr. Edison's experiments, inverse electrical currents must necessarily exist, notwithstanding the fact that the manifestations occur only at the *opening* or breaking of the circuit, we will discuss his typical experiment in detail. In Fig. 1, we have the



well-known arrangement for the production of the alleged new force. On the completion of the circuit, the battery current flows as shown by the arrows, and M becomes a magnet. On breaking the connection as at K_1 the so-called etheric force is manifested at the points P, in the dark box. It is evident that the above embraces all the essentials of Mr. Edison's experiments. When a battery current flowing through a considerable length of wire, is interrupted by breaking contact as at K, a bright spark of appreciable length is seen at the break (K). This spark is due to the extra current, and indicates a great increase of electrical tension in the wire, the discharge occurring through an appreciable air-space at K. It will be seen that the wire around the magnet is at the moment of breaking contact, charged with electricity of considerable tension (extra current), positive or negative, according to the direction of the battery current. In Fig. 1, since the magnet wire is connected with the positive pole C of the battery, the charge in the wire will be positive, and a negative charge will be accumulated on the general conducting surface of the battery, which thus acts in part to condense the negative charge. This state of tension at once disappears on the discharge of the extra current. The extra current is not produced until the circuit is broken, and its discharge takes place when the wires have been appreciably separated, as shown by the spark. At every break, therefore, the wire surrounding the core of the magnet accumulates a static charge of considerable tension, which is rapidly discharged. This charge, acting by induction on the core of the magnet, induces in it, and in all metallic masses in connection therewith, a flow or charge in one direction, *while the tension in the wire is increasing*, followed instantaneously by a flow or charge in the reverse direction for the re-establishment of electrical equilibrium in the cores of the magnet, *consequent on the discharge of the wire itself*, the wire and the cores of the magnets bearing the same relations to each other as the inner and the outer coatings of a Leyden jar. Here, then, we have all that is necessary for the production of the so-called etheric effects, apparent non-polarity included.

In order to prevent the possibility of a charge of any tension remaining in the coils of wire on the interruption of the current, we arranged the following experiment:—A battery of eight cells was divided into two sets of four cells each, as shown in Fig. 2. The sounder magnet M,



used in this experiment, was connected as shown, *i.e.*, one end of the coils with the positive pole of the left hand battery, and the other end to the negative pole of the right hand one. An interrupter placed midway between the remaining poles of each battery furnished the necessary breaks, as at K. Under these conditions we could obtain no appreciable spark in the dark box at P. In this experiment the magnet is placed so as to occupy the exact middle of the circuit, one-half the wire in the coils being influenced by that part of the extra current which produces a positive charge, and the other half by that which produces a negative one. When thus arranged the inductive effects of the extra current being equal and opposite, neutralise each other, and hence no inductive spark appears in the dark box P. In this experiment, thorough insulation of the batteries, key, and connecting wires, is necessary, in order to secure an equal division of the effective circuit.

The absolute necessity for the equality of the two divisions of the circuit and of the neighbouring conducting surfaces, in the above experiment, is shown by connecting any part of the circuit with a conducting surface, as, for instance, a mass of metal, or even the body of the experimenter, when sparks at once make their appearance at P. The mere approach of the person, *without* contact with any conducting surface near to any part of the circuit, or to either of the batteries, is followed by a similar result. In this connection it is evident that any inequality in the metallic surroundings of the halves of the circuit is sufficient to cause irregularity in the results. So necessary is the *equal* division of the conducting surfaces, that even the use of an ordinary telegraphic key at K is sufficient to introduce unequal metallic surfaces into the circuit, and so derange the experiment, and we would therefore suggest that the breaks be made by the conducting wires themselves. If the battery be unequally divided, sparks are seen in abundance in the dark box.

To test the question of the polarity of the alleged new force, the following experiment was devised:—The battery terminals were connected respectively with one end of the coils of the magnets M and M' which were exact counterparts of each other. The circuit was completed through the interrupter K, connected with the two remaining ends of the coils. Wires *a* and *a'* were provided for connecting the cores of the magnets with the dark box P, at pleasure. When the wire *a* was connected with P, sparks were seen in the dark box, in breaking the contact at K; similar sparks were seen where the wire from *a* was alone connected. When *both* *a* and *a'* were connected with the dark box *no spark could be obtained.*

In the foregoing experiment it is evident that the

polarity of the extra current produced in M is the opposite of that in M', representing, as they do, the positive and negative poles continued from the battery. Under these circumstances the induced charges in each core being opposite, neutralise each other, and no spark is seen. Since, however, contact of *a* or *a'* with M or M' singly gave all the so-called etheric manifestations, and that when

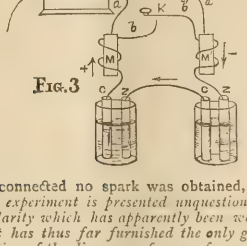


FIG. 3

both were connected no spark was obtained, *it is clear that in this experiment is presented unquestioned evidence of that polarity which has apparently been wanting, and which want has thus far furnished the only grounds for the assumption of the discovery of a new force.*

That the non-appearance of the spark at P was due to an exact neutralisation of the two opposite phases of the "etheric force," is shown by bringing any conducting surface, as the finger, into contact with any part of the circuit, as at *b* or *b'*, when sparks at once appeared at P.

We found that it was not necessary to employ cores surrounded by coils of wire to produce the so-called etheric force. We note the following experiment:—A hollow cylinder of non-conducting material as a test-tube was covered on the outside with a sheet of metal. A metallic bar was placed inside the tube, and from it a wire was led to the dark box. On connecting the exterior metal surface with almost any portion of a long battery circuit, which was interrupted, sparks were seen in the dark box at every break. These sparks possess all the properties claimed for the "etheric" sparks. In this case no person at all familiar with electrical induction would for a moment question the true origin of the sparks seen in the dark box.

Metallic coatings are not necessary to produce the effects just described. In the following experiment we

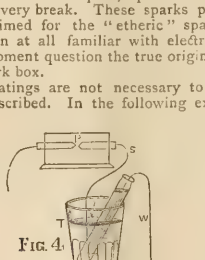


FIG. 4.

replaced them by liquid surfaces:—In a tumbler partly filled with slightly acidulated water, a test-tube is placed, also filled with acidulated water. The wire W, connected with the battery wire B, interrupted at K, is inserted in the test-tube. The wire S, in connection with the dark box, dips into the liquid in the tumbler. On interruption of the circuit, sparks appear at the dark box P. Comment is unnecessary.

It may be interesting to state that the foregoing experiments were thought out in accordance with the known laws of electricity, and the results fully confirmed our expectations. It is hoped that the foregoing experiments will have established still more decidedly the fact that *all the manifestations classed as "etheric" are due solely to inverse currents of induced electricity.*

NOTE ON THE FORMULÆ OF ALCOHOLS.

By WILLIAM ODLING, M.A., F.R.S.

THE accompanying table presents the formulæ of thirty-three alcohols. Of these, eight only are expressed by four-line formulæ, the remainder by three-line and two-line formulæ. Moreover, in order to manifest the relationship of the several formulæ to one another, the majority of them are written more cumbrously than would suffice equally well to exhibit the constitution of the several alcohols individually. Thus the formulæ of the two primary butylic alcohols, or propyl-methol and pseudopropyl-methol, would commonly be written $(HO)H_2C.C_3H_7$ and $(HO)H_2C.CH(CH_3)_2$, corresponding to the formulæ for the butyric and isobutyric acids, $HO_2C.C_3H_7$ and $HO_2C.CH(CH_3)_2$, respectively. The formula for secondary butylic alcohol, or ethyl-methyl pseudol, would be written—

$$(HO)HC\begin{cases}C_2H_5\\CH_3\end{cases}$$

corresponding to that of ethyl-methyl ketone—

$$OC\begin{cases}C_2H_5,\\CH_3\end{cases}$$

while the formula for tertiary butylic alcohol, or trimethyl kathol, would be written $(HO)C.(CH_3)_3$. Of the thirty-three alcohols represented, seven are referable in some way to meso-paraffins. In the formulation of these seven alcohols it has been preferred to denote the differently constituted radicals by index letters rather than to use more complex formulæ. In four of these seven formulæ, however, there occurs only the radical pseudopropyl,—

$$C_3H_7\pi \qquad \text{or} \quad -HC\begin{cases}CH_3\\CH_3\end{cases}$$

(more commonly called isopropyl), and in a fifth only the homologous radical, pseudobutyl,—

$$C_4H_7\pi \qquad \text{or} \quad -HC\begin{cases}C_2H_5\\CH_3\end{cases}$$

the secondary radicals derivable from the normal paraffins, propane,—

$$H_2C\begin{cases}CH_3\\CH_3\end{cases}$$

and butane,—

$$H_2C\begin{cases}C_2H_5\\CH_3\end{cases}$$

respectively. In the other two formulæ there occur respectively the primary and tertiary radicals, isobutyl,—

$$C_4H_9{}^{\sigma} \quad \text{or} \quad HC\begin{cases}CH_2-\\CH_3\\CH_3\end{cases} \quad \text{or} \quad -H_2C.CH\begin{cases}CH_3\\CH_3\end{cases}$$

and katabutyl,—

$$C_4H_9{}^{\kappa} \quad \text{or} \quad -C\begin{cases}CH_3\\CH_3\\CH_3\end{cases}$$

derivable both from the iso-paraffin,—

$$HC\begin{cases}CH_3\\CH_3\\CH_3\end{cases}$$

or isobutane.

It is to be noticed that the formulæ for all the several alcohols are constructed on the type of the formulæ of the several paraffins, normal, iso-, neo-, and meso- respectively, from which the alcohols are formed by substitution of hydroxyl, OH, for hydrogen.

The homologous iso-primary alcohols are derived from a typical iso-primary alcohol; and this typical iso-primary alcohol is derived from the normal secondary alcohol, as is the iso-paraffin from the normal paraffin:—

$$HC\begin{cases}CH_2(OH)\\CH_3\\CH_3\end{cases} \quad \text{from} \quad HC\begin{cases}OH\\CH_3\\CH_3\end{cases} \quad \text{or} \quad (HO)HC\begin{cases}CH_3\\CH_3\end{cases}$$

$$\text{as} \quad HC\begin{cases}CH_3\\CH_3\\CH_3\end{cases} \quad \text{from} \quad HC\begin{cases}H\\CH_3\\CH_3\end{cases} \quad \text{or} \quad H_2C\begin{cases}CH_3\\CH_3\end{cases}$$

PARAFFIN ALCOHOLS.

CH_4O.	C_2H_6O.	C_3H_8O.	$C_4H_{10}O$.	$C_5H_{12}O$.	$C_6H_{14}O$.
Methylic, and Normal primary Alcohols.					
$H_3C(OH)$ 66°	$H_2C\{^{OH}_{CH_3}$ 78°	$H_2C\{^{CH_2(OH)}_{CH_3}$ 98°	$H_2C\{^{C_2H_4(OH)}_{CH_3}$ 116°	$H_2C\{^{C_3H_6(OH)}_{CH_3}$ 137°	$H_2C\{^{C_4H_8(OH)}_{CH_3}$ 157°
		Normal secondary and Iso-primary Alcohols.			
	(*Continued.*)	$HC\{^{OH}_{CH_3}$ 83°	$HC\{^{CH_2(OH)}_{CH_3}$ 109°	$HC\{^{C_2H_4(OH)}_{CH_3}$ 130°	$HC\{^{C_3H_6(OH)}_{CH_3}$ 150°
$HC\{^{OH}_{C_2H_5}$ 106°	$HC\{^{CH_2(OH)}_{C_2H_5}$ 120—30°		$HC\{^{OH}_{C_2H_5}$ 97°	$HC\{^{CH_2(OH)}_{C_2H_5}$ 125°	$HC\{^{C_2H_4(OH)}_{C_2H_5}$ (?)
Iso-secondary and Meso-primary.	$HC\{^{OH}_{C_3H_7}$ (?)			$HC\{^{OH}_{C_3H_7}$ 119°	$HC\{^{CH_2(OH)}_{C_3H_7}$ (?)
	$HC\{^{OH}_{C_3H_7}$ (?)				$HC\{^{OH}_{C_4H_9}$ 137°
	$HC\{^{OH}_{C_3H_7}$ (?)			$HC\{^{OH}_{C_2H_5}$ 117°	$HC\{^{CH_2OH}_{C_2H_5}$ (?)
Neo-secondary.	$HC\{^{OH}_{C_4H_9}$ (?)				$HC\{^{OH}_{C_3H_7}$ 135°
		Iso tertiary and Neo-Primary Alcohols.			
Meso-Tertiary.	$C\{^{OH}_{C_3H_7}$ 112		$C\{^{OH}_{CH_3}$ 82°	$C\{^{CH_2(OH)}_{CH_3}$ (?)	$C\{^{C_3H_6(OH)}_{CH_3}$ (?)
				$C\{^{OH}_{C_2H_5}$ 95°	$C\{^{CH_2(OH)}_{C_2H_5}$ (?)
					$C\{^{OH}_{C_3H_7}$ 115°
					$C\{^{OH}_{C_2H_5}$ 120°

CHEMICAL NEWS, April 28, 1876.

Similarly, the homologous neo-primary alcohols are derived from a typical neo-primary alcohol; and this typical neo-primary alcohol is derived from the iso-tertiary alcohol, as is the neo-paraffin from the iso-paraffin:—

$$C\begin{cases}CH_2(OH)\\CH_3\\CH_3\\CH_3\end{cases} \quad \text{from } C\begin{cases}OH\\CH_3\\CH_3\\CH_3\end{cases} \quad \text{or } (HO)C\begin{cases}CH_3\\CH_3\\CH_3\end{cases}$$

$$\text{as } C\begin{cases}CH_3\\CH_3\\CH_3\\CH_3\end{cases} \quad \text{from } C\begin{cases}H\\CH_3\\CH_3\\CH_3\end{cases} \quad \text{or } HC\begin{cases}CH_3\\CH_3\\CH_3\end{cases}$$

Except for the use in a perfectly definite sense, and in a few instances only, of the index letters π, σ, and κ, as above referred to, the whole of the thirty-three alcohols are expressed by comparatively simple formulæ, which manifest their constitution fully, in symbols intelligible, without any new convention, to everyone.

NEW PROCESS FOR PREPARING SULPHO-CONJUGATED ACIDS.

By M. Ch. Girard.

The preparation of sulpho-conjugated acids requires in most cases the use of fuming sulphuric acid, or of a mixture of such with common sulphuric acid concentrated to 66° B. The presence of the fuming or Nordhausen acid is necessary to obtain disulpho-conjugated compounds, and those of a higher degree. We may replace with advantage—both as regards cost, facility of working, and amount of yield—the Nordhausen acid with anhydrous bisulphate of soda, either alone or mixed with variable quantities of the ordinary sulphuric acid of commerce. One of the chief advantages of the anhydrous bisulphate of soda lies in its mode of decomposition during the reaction, which has the effect of gradually setting at liberty anhydrous sulphuric acid. The author has prepared, by heating under pressure, and at temperatures varying according to the nature of the substance to be obtained, a mixture of anhydrous bisulphate of soda, concentrated sulphuric acid of commerce, and carbides of the aromatic series, such as benzin, toluen, xylen, and their homologues, naphthalin, anthracen, phenol, cresylol, quinons, and anthraquinons; with alkaloids such as aniline, diphenylamin, and their homologues, the operation may be performed at the ordinary pressure.

To obtain the disulpho-conjugated acids of benzin he heats under pressure for four hours to 200° to 250° a mixture of—

Crystallisable benzin	10	kilos.
Anhydrous sulphate of soda ..	15	,,
Commercial sulphuric acid	25	,,

The excess of the salt of soda may be removed either by exhausting with 3 or 4 litres of alcohol, or by letting the mass drain exposed to the air; the sulpho-conjugated acids being deliquescent, flow away, whilst the salt of soda remains in the funnels in a crystalline state. The excess of sulphuric acid is easily removed by neutralising with lime, filtering, and evaporating. To prepare the salt of soda he employs either the sulphate of soda collected or the carbonate of soda, filtering to separate the calcareous precipitate. The solution, evaporated to dryness, yields the soda salt, which latter, on heating to 240° with double its weight of potash, yields resorcin. To obtain the sulpho-conjugated acids of anthracen or of anthraquinon he heats under pressure between 260° and 270° for five to six hours, at 66° B.

Anthraquinon	10	kilos.
Anhydrous bisulphate of soda ..	12	,,
Commercial sulphuric acid	40	,,

The treatment to remove the excess of the salt of soda is the same as that described above; or the mixture may be directly neutralised with lime, the salt of lime decomposed by a salt of soda, sulphate or carbonate, and the sulphate of soda may be separated by crystallisation from the soda salts of the sulpho-conjugated acid.

The disulpho-anthraquinonate of soda, heated with double its weight of potash, soda, or a mixture of the two alkalies, is transformed into alizarin.—*Bull. Soc. Chim. de Paris.*

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. Hofmann.

(Continued from p. 167.)

Such machines have been recently made by Eigel and Lesemeister, of Cologne. The duty of a machine of the kind described must, on the supposition that the sulphuric acid expended is recovered by means of concentration, be estimated at a very high rate. From a calculation which certainly was only approximate it would appear that 17 kilos. of ice are produced per 1 kilo. coal used in concentrating the acid. If, in the continuous action of the apparatus, the concentrated acid running off could completely exchange its heat with the dilute acid to be introduced, the effect would be greater by one-third. This result considerably exceeds that of the ammonia machine. The manufacture of ice on this principle would offer certain advantages if the apparatus were differently arranged, since in its present form it is not suitable for lump ice. Perhaps instead of pure water a saline solution might be evaporated, which would be cooled down far below zero, and into which, as in other machines, vessels containing water might be plunged, and the latter might thus be indirectly frozen. The air-pump would require to be put in action only once in order to exhaust the air of the internal space. To open it would be needless, since the sulphuric acid can be introduced, and removed by means of pumps.

III. *Production of Cold by Expansion.*

If a gas is compressed the mechanical power applied is converted into heat and the temperature rises. If equal volumes of different gases at a similar initial pressure are compressed to the same extent, a gas of lower specific heat increases in temperature more than one of higher specific heat, and that in a potentiated manner since its particles, in the first place, assume a higher temperature by an equal increment of heat, and secondly, since the hotter gas possesses a greater tension and opposes more resistance to compression, whence more heat is evolved. Different gases of equal initial temperature and tension, when compressed to an equal volume, not only attain unequal temperatures, but unequal pressure. The following table shows in what proportion atmospheric air of mean tension increases in temperature if compressed at an initial temperature of 20° C.

Pressure in atmospheres..	1	2	3	4
Temperature	20	85	130	163

If a hot compressed gas is allowed to re-expand, always under full pressure, the heat is transformed into mechanical power, and a fall of temperature ensues in the same measure as the rise during its compression. If a hot and compressed gas is cooled down and then expanded, it falls below the initial temperature, and very great degrees of cold can be attained. Thus air at 2, 3, 4 atmospheres, cooled down to 30° C., and allowed to expand to 1 atmo-

* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzehends."

sphere yields respectively the temperatures of −25°, −53°, −70° C. It is pre-supposed that the air, like steam in an engine, works outwardly; if it rushes into an empty space the temperature of the whole mass experiences no change, since the heat lost by the initial expansion is reproduced by the impact of the molecules against the sides of the vessel. If the air drives before it a pressure smaller than corresponds to its own tension, *e.g.*, if, having been strongly condensed in a receiver, it escapes into the open air its fall in temperature is less than as stated above. On these principles depends the application of air to the production of cold and the preparation of ice.

(To be continued.)

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, April 20th, 1876.

Professor Andrews, F.R.S., in the Chair.

After the minutes of the preceding meeting had been read and confirmed, and the presents announced, the names of Messrs. J. Davidson, D. H. Richards, and W. J. Hannah were read for the first time. Mr Cornelius O'Sullivan and Dr. Rudolph Messel were balloted for and duly elected Fellows of the Society after their names had been read the third time.

The first paper, "*On the Manufacture of Sulphuric Anhydride*," by Dr. R. Messel and Dr. W. Squire, was read by the latter. The speaker, after giving a sketch of the history of the manufacture of sulphuric acid, described their process for preparing the anhydride. The vapour of ordinary sulphuric acid is passed through a white-hot platinum tube, whereby it is almost completely decomposed into water, oxygen, and sulphurous anhydride: the mixed gases, after passing through a leaden worm to condense the greater portion of the water, are completely dehydrated in a leaden tower filled with coke, over which a stream of concentrated sulphuric acid is allowed to trickle. The dry mixture of oxygen and sulphurous anhydride is now passed through platinum tubes heated to low redness, and containing fragments of platinised pumice, when the gases re-combine to form sulphuric anhydride, which is condensed in a series of Woulffe's bottles.

The Chairman thanked the authors, and, in allusion to a remark of theirs on the difficulty of condensing sulphuric anhydride when mixed with air, said that, in the case of a mixture of equal volumes of air and carbonic anhydride, the latter did not condense even at a most enormous pressure, but on lowering the temperature to 0° C. the carbonic anhydride was condensed.

Dr. Armstrong remarked that the authors had spoken of the Nordhausen acid as a solution of sulphuric anhydride in sulphuric acid, but it was in reality a definite compound, which yielded definite salts and also a corresponding chloride. It might perhaps be called pyrosulphuric acid.

In reply to an observation by Mr. Spiller, Dr. Squire said the Nordhausen acid made in Bohemia was of two strengths, but all the samples he had examined had a sp. gr. considerably below 1·900.

The adjourned discussion on Dr. Armstrong's paper, "*On Systematic Nomenclature*," was then proceeded with.

The Author said he might perhaps be allowed to make a few additional remarks. At the last meeting he had scarcely been able to do justice to Dr. Odling's paper, chiefly from want of diagrams to illustrate it. These he had now prepared, and from an inspection of them it would be evident that in the highest series there would be several isomeric, iso-, neo-, and meso-paraffins, and for these Dr. Odling's system did not provide names. He considered Schorlemmer's arrangement of the paraffins unsatisfactory and unscientific, and in its place he would propose to divide them into three groups, represented by the general formulæ $CH_2(C_nH_{2n+1})_2$; $CH(C_nH_{2n+1})_3$; and $C(C_nH_{2n+1})_4$ respectively, the various members of which could be distinguished by the letters of the Greek alphabet in the manner before explained. He desired to see some system of nomenclature which would not only serve to distinguish isomeric compounds, but would assimilate the different series as much as possible. The one he had proposed served to indicate the position which the isomeric compounds occupied with reference to their physical properties.

Dr. Odling said that he had, in the first place, to express both his appreciation of the friendly tone of Dr. Armstrong's criticism, which he would endeavour to imitate in his reply, and also his obligation to him for bringing the subject forward. He objected himself to Dr. Armstrong's proposal, that it dissociated strictly analogous alcohols by assigning to them a difference of prefix, whilst it associated with one another by an identity of prefix alcohols of the most diverse character, normal and iso- primary, secondary, and tertiary. It moreover dissociated the alcohol from the acid and paraffin into which it was oxidisable and reducible, by a difference of prefix, and accorded a common prefix to those which were not so related to one another. He considered the arrangement of isomeric bodies according to their boiling-points to be inapplicable in the case of isomerides, including (say) aldehyds, ketones, olefine alcohols, olefine ethers, olefine oxides, &c., without prior classification of the isomerides according to their several characters, and similarly with regard to normal and iso- primary, secondary, and tertiary alcohols. He objected, further, that any seeming consistency in Dr. Armstrong's seriation of alcohols was dependent on this seriation being conducted according to a special artificial system which it was assumed would coincide with the seriation by boiling-points; but which he (Dr. Odling) contended would not accord, unless, for example, the relationship between similar primary butyl and propyl derivatives were reversed in the case of secondary butyl and propyl derivatives, and unless, whilst some alcohols differed from their progenitors in boiling-point by about 20° C., other alcohols—derived in precisely the same way—differed from their progenitors in boiling-point by about 40° C. For his own part he considered that the $\alpha\beta\gamma$ system of notation was applicable only as a temporary expedient in the case of compounds in the course of being assimilated into the body of investigated and systematised substances. He believed Dr. Armstrong's formulæ for the alcohols to be confusing, in respect of the number and variety of indices employed; to be cumbrous out of proportion to the information afforded with regard to any particular alcohol; and to fail in indicating the close mutual relationship of some, and the great mutual alienation of other isomeric alcohols. He further objected to Dr. Armstrong's proposal with regard to the nomenclature of isomeric acids. To designate these acids as primary, secondary, and tertiary, was to use the above epithets in an entirely different sense from that in which they are applied to alcohols. In this last sense all acids are primary, and their varieties are dependent on the variety of paraffin from which they are derived; moreover, inconvenience would result from referring the alcohols to a mono-carbon alcohol, and the acids to a dicarbon acid. As regards his own proposals, Dr. Odling contended that the reference of the known paraffins to four types was perfectly well established, and that any familiar mode of designating the different isomeric paraffins should indicate to which of these classes the paraffin belonged, and that any prefix such as "iso" applied to the members of some one class of these paraffins should be confined exclusively to them, and to their derived alcohols, aldehyds, acids, &c. He recognised fully that any paraffin of of a more complex class might be formulated

on the type of a paraffin of a simpler class; that hydride of amyl, for instance, —

$$HC\begin{cases}C_2H_5\\(CH_3)_2\end{cases}$$

might be written on the type of ethane, $H_3C.CH_3$, or on that of propane,—

$$H_2C\begin{cases}CH_3\\CH_3\end{cases}$$

or on that of isobutane,—

$$HC\begin{cases}CH_3\\CH_3\\CH_3\end{cases}$$

and that the paraffin sometimes called di-isopropyl, although belonging to the class of meso-paraffins, might very well be formulated on the type of the iso-class. He further considered that in the description of the monad radicles derivable from the paraffins, it was advisable to give to the secondary radicles derived from the normal paraffins a different prefix from that assigned to the primary radicles derived from the iso-paraffins, and also to accord a distinctive prefix to the tertiary radicles of the iso-paraffins, the prefixes which he suggested being "pseudo" and "kata" for the secondary and tertiary radicles respectively. With regard to the designation of the isomeric alcohols, he thought it was advisable to indicate whether they were derived from normal or iso-paraffins, and whether they were primary, secondary, or tertiary derivatives. He further thought it would be advisable to give to the secondary and tertiary alcohols substantive names, such as the name ketone given to the secondary aldehyds, the names he suggested being pseudol and kathol respectively, whilst the primary alcohols might be designated as methols; these terms being used in the same manner as, and included in, the common designation of carbinol. Lastly, whilst admitting that every variety of formulation was admissible to illustrate special relations, he considered that particular mode of formulation to be most generally advantageous in which a set of alcohols, glycols, olefines, aldehyds, ketones, acids, nitriles, &c., should be expressed by similarly constructed formulæ, which would show at a glance the relations of the several bodies to one another, and especially their common relation to the paraffin from which they are derivable.

Dr. Armstrong said that at that late period of the evening there was no time to reply to Dr. Odling's remarks, but he might say there was less difference between their views than might at first sight appear. He might observe, however, that he desired to use the Greek letters as prefixes merely to show the order in which isomeric bodies would be arranged, having regard to their physical properties.

The Chairman then adjourned the meeting until Thursday, May 4th, when the following papers will be read:—"*On Glycerin-Phosphoric Acid and on Fermentation*," by Dr. Thudichum and Mr. Kingzett. "*Note on the Occurrence of Benzene in 'Rosin' Light Oils*," by Mr. W. Smith. "*On the Action of Water and Various Saline Solutions on Copper*," by Mr. T. Carnelly. "*On some New Reactions of Biliverdin*," by Dr. Thudichum. And "*On Fermentation*," by Dr. Thudichum and Mr. C. T. Kingzett.

CORRESPONDENCE.

THE NECESSITY FOR ORGANISATION AMONG CHEMISTS.

To the Editor of the Chemical News.

Sir,—I have taken great interest in the discussion opened up by Dr. C. R. Alder Wright, upon the necessity for organisation among chemists. I am also greatly surprised at the little response it has called forth.

The wretched position to which professional chemists are drifting, and the low opinion held of analytical chemistry, is well illustrated by the advertisement to which you refer in your article in the Chemical News (vol. xxxiii., p. 89).

I observed a few months ago, in a mining paper, an advertisement, emanating from a spelter works in Glamorganshire, for a chemist (?) "competent to make the analysis of zinc ores," and who could keep accounts—salary £2 a week. From enquiry and experience I believe I shall not be far out when I state that of chemists in works about 50 per cent receive salaries under £100, and 80 per cent under £150 per annum.

It is perfectly true, as Dr. Wright observes, most of these have merely risen from "bottle-washers," and who have learnt to determine certain substances by mere rule-of-thumb, and are perhaps more adept, from constant experience, at that one thing than even a skilled chemist of more extensive knowledge; but if given any different substance or element to determine, are totally at sea, and entirely incapable of working by induction.

It is a very general thing, in many commercial laboratories, for youths to be employed entirely at one certain thing; for instance, at an "Assay Office" with which I am acquainted one boy is kept to do all the weighing, another all the H_2S precipitations, so that in a single determination the manipulation will have passed through three or four different hands, and the results are then returned as gospel: if they should happen to turn out correct it is by a happy dispensation of Providence,—if not it cannot be helped; and this is done by those holding high positions as commercial analysts.

But then, Sir, the rate of fees quoted by these people will not admit of doing honest work. Will it pay a man (of any position above that of bottle-washer) *himself* to do an analysis of an iron ore, determining Fe, Mn, S, P, Ca, Si, Al, and Mg, for £3 10s. (which is the advertised price of many firms),—to do it in duplicate, and be able (as advised by Fresenius) to *swear* to his results? and yet how many brokers and manufacturers will quibble over £5 for an analysis, seemingly forgetting that every £1 saved by employing an inferior chemist may entail a loss of £100 on themselves. Take the case of copper ore. I imagine very few commercial assayers or analysts *bother* to determine the copper within 0·25 per cent over or under the actual quantity present, and yet this would represent 4s. per ton; and as this ore is often bought in parcels of 1000 tons, would represent a loss or gain in the parcel of £200.

I am sure that if a guild or similar institution were established all our best chemists would become members. There seems many varieties of opinion as to how, and in what subjects, the examination should be held. They should certainly be such, and only such, as would be required to see if a candidate is capable of practical chemical work, and to perform correct and trustworthy qualitative and quantitative analysis. I certainly do not see the necessity (as suggested by one of your correspondents) for *Latin*, German, and French to form any of the subjects. A man may be possessed of great skill and experience, and yet not know a word of any but his own language. The subjects should be confined strictly to practical and theoretical chemistry, and not go into subjects of general education. It is not for a University degree.

I would beg to suggest that the candidate for membership of the guild should fulfil the following conditions:—

1. That he shall prove satisfactorily to the examining body, or other constituted authority, that he has received his chemical education under a person of professional status and ability, or in some recognised institution.
2. That he is engaged in practical chemical work, and is following chemistry as a profession.
3. That he can pass a practical examination in analysis, qualitative and quantitative, and in theoretical chemistry, equal, say, to the papers given to the

students of the School of Mines who are competing for the Associateship.

Of course the latter would be the main thing necessary for a candidate to pass, and should be of a sufficient stiffness to prove that he had received a thorough chemical education, and was not a "bottle-washer" chemist. This third section might also be divided into organic and inorganic, either of which might be taken by the candidate, as, considering now the wide range of chemistry, one of these is quite sufficient for a man to make his speciality, and it would be unfair if he intended to confine himself to inorganic (or metallurgical) chemistry, as his sole profession, to make him pass a strict examination in organic, and *vice versa*. We have a parallel in the medical profession, as in physician and surgeon.

The diploma granted might specify which it was granted for. It may be urged against this that it would cause complications, but even if it did it would soon cease to exist. We have a parallel among several of the allied professions; for instance, we have civil, mechanical, and mining engineers: besides it would show who was the most proper man to consult on any special subject, so that a client would not go to, say, Dr. Percy to consult him regarding "previous sewage contamination" in a sample of water, nor to Mr. Wanklyn to consult as to the commercial value of an argentiferous copper ore. Besides, if he could, the candidate may pass in both inorganic and organic; but what I wish to urge is the unfairness of mixing the two.

From the general tone of your correspondents' letters they seem to insinuate that this guild is to be formed to support commercial analysts, but I think it should certainly embrace works' chemists, who require quite as high a degree of skill as our commercial friends, considering that they generally have to work against them, and the operations often occurring in manufactures involving chemical questions.

The diploma of the guild would also at once place a chemist seeking for an appointment in a more favourable position than now, when he has to contest with "bottle-washers" and students fresh from the class-rooms, besides enabling him to command a salary at least equal to that of a collier in full work, instead of the wretched salaries many receive—not being more than that paid to a yard foreman or inferior clerk.

I can assure you, Sir, that many skilled artizans in the various Birmingham trades can earn far higher salaries than the income of many of our professional chemists. To quote a case:—I am acquainted with a hammerman at a Steel Works in Glamorganshire who received a standing salary of £400 per annum.

I perfectly agree with you, Sir, that those persons rejoicing in a sufficient private income had far better devote themselves to original research than degrade themselves and the profession by doing work at wretchedly low fees. What would be thought of a barrister who pleaded causes at half-a-crown a head? I imagine he would be very soon ejected by his profession; and the cases are exactly similar.

I shall be glad to hear that a movement is being made by the metropolitan chemists towards the formation of this guild, and can assure them that they will meet with the hearty co-operation of their provincial brethren. Could they arrange a meeting, and let a report of the minutes be sent to every F.C.S.? Subscriptions might be invited to defray expenses of same. But unless something is done the profession of analytical chemist will degenerate to such an extent as not to be worth following, especially as it is becoming combined with that of clerk, foreman, and messenger. Perhaps we shall soon see the public analyst also performing the office of parish beadle.

In conclusion I would beg to observe, to brokers, manufacturers, &c., in the words of a celebrated physician, that "advice that costs nothing is worth nothing."—I am, &c.,

C. H. Alldred, F.C.S.

Burry Port, S. Wales, April 10, 1876.

ORGANISATION FOR ANALYTICAL CHEMISTS

To the Editor of the Chemical News.

Sir,—I cannot allow this subject to pass from the notice of your readers without publicly recording my vote in its favour. It is beyond doubt that such a step is not only desirable, but absolutely necessary, to secure the position due to the profession. Medical men, lawyers, pharmacists, and even druggists, are very properly *obliged* to show due qualification before they can practise or commence business, but anyone can call himself an analytical chemist without possessing the meanest claim. I say it is time analytical chemists established a *locus standi* against such intrusion. During my practice I have heard, in Law Courts and elsewhere, more ridiculous statements, if possible, than those recorded by Mr. A. H. Allen (Chem. News, vol. xxxiii., p. 94). Undoubtedly there will be some difficulty at the commencement of such an organisation, but the difficulties will increase with time; therefore action cannot be taken too soon.

I look upon the general suggestion of Mr. C. H. Piesse (Chem. News, vol. xxxiii., p. 116) with general favour. A board consisting of our *recognised leading Professors* would give general satisfaction, in first of all passing those for members who have *unquestionable* qualifications, and then considering the merits—by examination or otherwise—of all the analytical chemists in practice, making it compulsory afterwards for certain qualifications to be attained before being allowed to practise as an analytical chemist.

Promising my share towards preliminary expenses to form such an organisation—I am, &c.,

E. W. T. Jones.

Public Analysts' Laboratory, 10, Victoria St., Wolverhampton, April 4, 1876.

PS.—I think Mr. Allen will find himself and all public analysts exempt from jury service by being public officers.

BOILING-POINTS AND VAPOUR VOLUME.

To the Editor of the Chemical News.

Sir,—1. Can anyone kindly tell me how it is that of bodies reputed to have the same type and the same vapour volume, the denser should have the lower boiling-points?

	At. weight.	Boils.
Meth-alcohol	32	66°
Alcohol	46	78°
Meth-mercaptan	48	21°
Mercaptan	62	36°

2. Also, do I understand B. Aronheim correctly that phenyl-butylen ($C_{10}H_{12}$) has for atomic weight 132, and vapour density 132 = 1 vol., the normal boiling-point quite precluding any idea of its being a polymer? (Chem. News, vol. xxvii., p. 46.)

3. Can anyone refer me to a satisfactory determination of the atomic weight of mercury? I have followed with much distrust the usual 200 and (2 vols.), but how often do we see that metal evincing the equivalence of 2H?

Silver acetamide .. .. .. AcHAgN
Mercury „ .. .. .. AcHgN, &c.

If it be settled that copper may have two allotropic forms with a certain equivalence of mono- and di weight, might not the same allotropism explain the anomalies of Hg as normally 100 and 1 vol.?—I am, &c.,

S. E. P.

Fall of a Meteorite.—The *Wolverhampton Evening Express* of the 22nd inst. records the fall of a meteorite near Wellington, on the afternoon of the 20th inst. It weighed about 8 lbs., and had penetrated to a depth of 18 inches, passing through 4 inches of soil and 14 inches of solid clay down to the gravel.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances, de l'Academie des Sciences. No. 14, April 3, 1876.

Detection of Vinic Alcohol in Mixtures, and especially in Presence of Wood-Spirit.—MM. A. Riche and C. Bardy.—The method of the authors depends on the following principles:—Aldehyds turn the red colour of the salts of rosaniline to a violet. Methylal and acetal possess the same property. This colour resists the action of sulphurous acid, which readily discharges magenta. If the liquid does not mark 80° on the alcoholometer—the case with all commercial alcohols—4 c.c. are poured into the body of a small retort, and 6 c.c. of ordinary sulphuric acid are then carefully added. After having warmed the apparatus for an instant 10 c.c. of water are added, the apparatus is stoppered and heated, and 7 to 8 c.c. are allowed to distil over into a graduated test-tube in which have been put 10 c.c. of water. Into the test-tube are further poured 5 c.c. of sulphuric acid at 21° B., and 10 c.c. solution of permanganate of potash at 4° B. After from three to five minutes the liquid will have become decidedly brown, and 4 c.c. of hyposulphite of soda at 33° B. are added, and then the same measure of a solution of magenta at 2 centigrms. per litre. If the liquid in question marks less than 80° it is diluted with water down to 5°, and 30 c.c. are taken and distilled with 10 c.c. of sulphuric acid, and 12 c.c. are collected and mixed successively with 4 c.c. of acid and the other reagents in the proportions given above. Under these circumstances wood-spirit gives a yellowish white liquid, whilst if it is accompanied by vinic alcohol the liquid takes a violet colouration, the more intense in proportion to the quantity of such alcohol. The operation requires only a few minutes, and the test-tube is marked so as to indicate the quantities of the reagents to be introduced. Aceton, formic acid, isopropylic alcohol, do not give a colouration under these circumstances. But the case is different with the propylic, butylic, and amylic alcohols. This is not of practical importance, because these alcohols are not found in commerce in a separate state, and only occur in vinic alcohol. In this case, however, the authors let down the alcohol to 5°, and treat successively with 5 c.c. of acid, 5 c.c. of permanganate, 2 c.c. of hyposulphite, and 4 c.c. of magenta. The methylic, butylic, and amylic alcohols yield a sulphur-yellow solution, the propylic gives a greenish grey tint, whilst vinic alcohol produces a purple colouration.

Justus Liebig's Annalen der Chemie, Band 180, Heft 3.

Researches carried on in the Laboratory of Prof. v. Gorup-Besanez, of Erlangen.—These consist of papers on certain compounds of tellurium, by Dr. F. Becker; on certain constituents of Angelica root, by Dr. Carl Brimmer; and on the preparation of glycol, by Otto Lietzenmayer. Dr. Becker obtains pure tellurium by the following process:—Into a combustion-tube 80 centimetres in length he introduced a plug of asbestos so as to remain at the distance of 20 centimetres from the end. Upon this followed coarsely powdered crude tellurium (containing 75 to 80 per cent of pure tellurium), and in front of that another asbestos plug. The back end of the tube was then connected with a gas apparatus, fitted up so as to furnish a current of perfectly dry hydrogen. To the mouth of the tube was fitted a descending tube, and the tellurium was then heated to redness in the combustion-furnace. The combustion-tube must be heated very strongly from its posterior end to beyond the second asbestos plug, and the current of hydrogen must be uninterrupted. The sublimination then goes on readily and quickly. The residue between the two asbestos plugs containing metallic tellurides was heated in dry chlorine gas. Chloride of tellurium was deposited in the cool parts of the apparatus as a yellowish white powder. Thick layers of pure tellurium, when fused, appear yellowish brown and translucent. A small amount of telluride of hydrogen is formed on subliming tellurium in hydrogen gas. Telluric acid is most readily formed by dissolving tellurous acid in nitric acid, and adding peroxide of lead in slight excess. The precipitates obtained by passing sulphide of hydrogen into solutions of tellurous and telluric acids are not definite compounds, but merely mixtures of tellurium and sulphur. Attempts to prepare a carbide, a cyanide, and a nitride of tellurium were not successful.

Communications from the Laboratory of the University of Halle.—These consist of a paper on the action of sulphuretted hydrogen upon the alkaloids, by Ernst Schmidt; an account of β-naphthoe acid, by Paul Vieth; and a paper on dipseudo-propyl-keton and methyl-pseudo-propyl-keton, by R. Münch.

Remarks on the "Mercuric Oxyrhodanid" described by A. Fleischer.—J. Philipp.—The author, having described the same body some years ago, differs from the views of Fleischer as to its constitution.

On Gentisin.—H. Hlasiwetz and J. Habermann.—If gentisin is treated with sodium amalgam an orange solution is first obtained, which passes quickly into deep green, brownish red, and then becomes almost colourless. On the addition of dilute sulphuric acid a cherry-red amorphous body is thrown down, which, when washed, becomes a cochineal-red, dissolves in ammonia with a red colour, and is re-precipitated by acids. Its formula appears to be $C_{13}H_{13}O_4$, differing from that of gentisin merely by CO.

Milky Juice of Cynanchum Acutum.—A. Butleroff.—Already noticed.

Bulletin de la Societe Chimique de Paris, No. 6, March 30, 1876.

Note on Sulpho-phenyl-urea.—M. P. de Clermont.—The author causes hydrochlorate of phenylamin to act upon sulphocyanide of ammonium in equivalent proportions at the temperature of 100° C. in the water-bath, and obtains thus sulpho-phenyl-urea. If this substance is heated to 180° in a closed vessel it is decomposed, yielding a mixture of sulphocyanic acid, ammonia, phenylamin, hydrosulphate of ammonia, and diphenyl-sulpho-carbamide.

Determination of Nitrogen in Organic Compounds.—M. A. Dupré.—The author proposes a modification of the well known process of Dumas. His method cannot be understood without the accompanying illustration.

Secondary Monamines formed by the Action of Liquid Toluydin upon the Hydrochlorate of Aniline.—Ch. Girard and E. Willm.—The authors obtain phenyl-ortho-cresylamin in hard, brilliant, crystalline needles, which, if treated with a drop of sulphuric and nitric acid, produce a fine blue colouration. Solid dicresylamin gives a straw-yellow colouration in contact with nitric acid. Among the other products are diphenylamin, and a body which gives with nitric acid a blue colouration inclining to violet, and which is liquid phenyl-toluydin, phenyl-para-cresylamin, or perhaps ortho-para-dicresylamin.

On Sulpho-naphthalide.—M. P. T. Clève.—The author finds the composition of this body to be—

Carbon	75·48
Hydrogen	4·40
Sulphur	10·06
Oxygen	10·06
	100·00

answering to the formula $C_{20}H_{14}SO_2$. Its composition is the same as that of sulpho-naphthalin.

Action of PCl_3 on β-Naphthol.—P. T. Clève and H Juhlin-Dannfelt.—The result of the reaction is β-mono-

chlorated naphthalin, a crystalline mass having the consistence and appearance of stearin. It consists of—

Carbon	73·84
Hydrogen	4·31
Chlorine	21·85
	100·00

Action of Compound Ammonias upon the Sulphocyanates of the Acid Radicals.—M. P. Miquel.—The author has obtained by this action phenyl-acetyl-sulphurea, phenyl-benzoyl-sulphurea, and benzyl-benzoyl-sulphurea.

Composition of the Black Matter obtained on Calcining Ferrocyanide of Potassium.—M. A. Terreil.—Already noticed.

MISCELLANEOUS.

Sanitary Conference.—A Sanitary Conference, convened by the British Medical and Social Science Associations, will be held on the 11th and 12th of May, 1876, at the rooms of the Society of Arts, John Street, Adelphi, commencing at 11 A.M. on each day, under the presidency of the Right Hon. the Lord Aberdare. The following are the points to which it is proposed specially to direct the attention of the Conference:—

1. Do the existing boundaries of urban and rural districts furnish such a division of the country as enables authorities to exercise their powers and fulfil their obligations, for sanitary and other purposes of local government, in the most effective manner?

2. What preliminary inquiries, if any, are necessary to determine the question? and if, ultimately, districts should be reconstructed—

a. What principles should govern their reconstitution?

b. How can this reconstitution be best carried into effect?

3. Should there be more than one authority within the limits of any one of the boundaries so reconstituted, or should area and authority coincide; and should all authorities have the same obligations, be governed by the same sanctions, and be invested with the same powers? Should new authorities be constituted, and is it desirable to have any intermediate representative local board between sanitary authorities and the local government board?

4. Are the powers already granted to local sanitary authorities in any respect inadequate to fulfil their intention: and should all powers and purposes of local government be vested in, and carried out by, one and the same authority.

5. What, if any, alteration should be made in the incidence of taxation for sanitary and other purposes, so as to insure that payments should, as nearly as possible, coincide in amount with direct benefits?

6. What executive officers are essential to good local administration, and how should they be appointed, regulated, and paid?

7. What alterations, if any, in the central executive organisation, are needed to augment the efficiency of local administration?

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

Improvements in the treatment of ores and minerals for the purpose of obtaining useful products therefrom. E. Tanner, F.C.S., Dublin, Ireland. January 25, 1875.—No. 279. The invention consists in the treatment of ores and minerals which contain zinc, lead, copper, silver, gold, iron, and sulphur, and of which the "bluestone" found in the Isle of Angelsea may be taken as an example. The chief advantage obtained is the separation of the zinc and lead from the ore or mineral. The ore or mineral is first reduced to a state of fine division, and treated with hydrochloric or sulphuric acid, or with other chlorides or sulphates capable of bringing the zinc and lead into a soluble condition. The solution is then submitted to a series of decompositions and precipitations for the treatment of the metals contained therein.

Improvements in the manufacture of inkstands. H. C. Coombe, Barnsbury, Middlesex. January 25, 1875.—No. 297. The inventor takes a certain quantity of the ordinary starch, and dissolves same in hot or boiling water as is usually done, and, whilst hot, introduces into the starch oil, wax, or any suitable greasy matter, and stirs the mixture, and same is allowed to cool. When the mixture is cold a small quantity of iodine dissolved in spirits of wine is added, and the result of the addition of the iodine is that the mixture is converted into a bluish black colour. To a gallon (more or less) of the above mixture is added about 8 ounces more or less of a solution of perchloride or other persalts of iron, and also a small quantity of gallic or tannic acids singly or mixed, and, following this, about 2 drachms of oil of cloves with 8 ounces of glycerine (more or less) is added and thoroughly stirred. In making superior blacking suitable carbon blacks are added.

Improvements in purifying gas, in regulating and rendering excessive pressures and other useful resistances, and in the apparatus employed therein. J. Simmons, Kegent Street, London, and J. M. Morris, Hanover Street, London, W. January 25, 1875.—No. 289. An improved method of purifying hydrogen gas by filtering it through a mixture of lime and water is described; also an improved construction of apparatus combining within itself a purifier and gasometer; also an improved means of emptying the retorts when necessary.

An improved carbonaceous material suitable for filtering, deodorising, and other analogous purposes, and the apparatus employed in its manufacture. E. Weare and S. Isherwood, both of Manchester. January 28, 1875.—No. 326. The features of novelty in this invention consist in the production of an improved carbonaceous material by mixing clay with sawdust, clinkers, and refuse from furnaces, together with tanners' waste or the nuts used by tanners, and charring the mixture in an apparatus consisting of three, five, seven, or more cylinders revolving in or over a furnace, and arranged in the case, say of three, with two small upper cylinders and one large lower cylinder. The material is fed into the top cylinder, and after being partially carbonised passes through suitable hoppers to the lower one, all the extremities of these cylinders being fitted with covers to obtain ready access to the interior.

An improvement in purifying iron, and in apparatus used therein. W. Baker, Willenhall, Stafford. January 28, 1875.—No. 327. The inventor employs a vessel or trough placed between the furnace and the moulds, or other receiver for the molten metal, and forms the vessel or trough preferably oblong, and a few inches deep on one side, and shelving up to the top on the other side. He closes the ends of the vessel or trough to retain the metal to be acted upon, and forms an opening in the top of each end, one for the admission and the other for the discharge of the molten metal. He forces air through tuyeres placed along that side of the vessel or trough to which the bottom shelves up, and inclines the tuyeres towards the surface of the metal with their nozzles nearly touching the metal, so that the air will be forced into and through the metal. He carries up the sides of the vessel or trough and covers the top with a perforated plate. The metal flows through the vessel or trough, and is purified by the action of the injected air.

Improvements in apparatus for the manufacture of chlorine. H. Deacon, Appleton House, Widnes, Lancaster. January 28, 1875.—No. 331. This invention consists in the construction and use in the manufacture of chlorine of a vessel containing gratings so supporting the chemically active porous material that it may be easily withdrawn and replaced and form on its upper and under surfaces angles with the horizon parallel to each other, and such vessel being provided with suitable openings for the introduction and withdrawal of the chemically active material, and for the entrance and exit of the gases which pass through it, the withdrawable porous material.

An improved coating for iron and other metals. W. R. Lake, Southampton Buildings, London. (A communication from D. R. Brownow and G. W. Francis, both of Middletown, Connecticut, U.S.A.) January 29, 1875.—No. 340. This invention relates to an adhering coating for iron and other metals, composed of the ordinary slag from an iron furnace, or its equivalent, and borax, or other equivalent flux, by means of which the metal is perfectly protected from the action of the air or of moisture, and so that the metal can be subjected to a high degree of heat without injury to itself or the said coating.

Improved processes and apparatus for manufacturing ice, cooling buildings, and other cooling or refrigerating purposes. C. P. N. Weatherby, Southampton Buildings, London. January 29, 1875.—No. 351. My invention relates, first, to the production of cold by a peculiar method and apparatus by which atmospheric air is compressed, cooled, and expanded more effectively than heretofore. It is desirable in making ice according to these improvements to reduce the air passing through the ice-house or refrigerator to as low a degree as possible. In carrying into practice this part of my invention I use apparatus or machinery consisting of steam cylinders, various force-pumps, water-jet pumps, expansion-power cylinders worked, by compressed air, an ice chamber containing near the centre a water-vessel in which the water is frozen, and a graduated vessel* to supply water to the said ice-box. I modify my invention by combining the cooling effect produced by the alternate compression, cooling, and evaporation of a gas, leaving a low boiling point, or of a condensable

* The words "in which the water is frozen, and a graduated vessel" are found in the copy of the abridgment delivered by the applicant, but do not appear in the original abridgment.

gas, and the cooling effect produced by the alternate compression, cooling, and expansion of atmospheric air.

Improvements in filtering apparatus intended chiefly to clean rain-water during its flow from roofs to reservoirs. C. Lambert, Spark Island, Hull, York. January 7th, 1875.—No. 360. The apparatus consists of an outer casing attached to the wall of the house to which is an inner vessel into which the water is led. The upper part of the inner casing has holes through which the water passes into a filtering medium held between perforated plates through which it passes to a reservoir.

NOTES AND QUERIES.

*** **Our Notes and Queries column was opened for the purpose of giving and obtaining information likely to be of use to our readers generally. We cannot undertake to let this column be the means of transmitting merely private information, or of such trade notices as should legitimately come in the advertising columns.**

Nitrous Compounds.—Can any of your readers inform me of the best method of getting rid of nitrous compounds in commercial sulphuric acid?—A SUSSEX BOY.

Sawdust Manure.—Sawdust that has been used in stables for the bedding of horses (in lieu of straw) is found to have a less beneficial effect upon land than manure of straw. Could any reader inform me—(1) What is the probable cause of this? (2) What would be a likely remedy? (3) Would keeping the manure for a lengthened time make it serviceable?—F. H. T. A.

Potassium Flame.—Text-books and teachers generally aver that a potash salt can be detected in presence of a soda salt by looking at the flame through a blue glass, when it appears violet or reddish violet. Recently I obtained a reddish violet flame from common salt, crystallised carbonate of soda, and Howard's pure carbonate of soda, and also from sodium ignited on water. Would some one kindly explain this?—F. H. T. A.

MEETINGS FOR THE WEEK.

SATURDAY, 29th.—Physical, 3. "On an Improvement in the Heliostat," by Sir John Conroy, Bart. "On the Supposed New (Etheric) Force," by S. P. Thompson.

MONDAY, May 1st.—Medical, 8.
— Royal Institution, 2. (Annual Meeting).
— Society of Arts, 8. Cantor Lectures. "Wool Dyeing," by George Jarmain.

TUESDAY, 2nd.—Civil Engineers, 8.
— Royal Institution, 3. "Comparative Geology and former Physical Geographies of India, Australia, and South Africa," by Prof. P. M. Duncan, F.R.S.
— Zoological, 8.30.

WEDNESDAY, 3rd.—Society of Arts, 8. "Preparation of China Clay," by J. H. Collins.
— Microscopical, 8.

THURSDAY, 4th.—Royal, 8.30.
— Chemical, 8.
— Royal Institution, 3. "On Voltaic Electricity," by Prof. Tyndall, D.C.L., LL.D., F.R.S.
— Royal Society Club, 6.30.

FRIDAY, 5th.—Royal Institution. 8. Weekly Meeting. 9. "On Methods of Chemical Decomposition Illustrated by Water," by Prof. Gladstone.
— Geologist's Association, 8.
— Society of Arts, 8. (Indian Section). "Irrigation Works in India," by W. T. Thornton.

SATURDAY, 6th.—Royal Institution, 3. "On Crustacea," by Henry Woodward.

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St. Bartholomew's Hospital, E.C.,
April 22, 1876.

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THE CHEMICAL NEWS.

Vol. XXXII. No. 858.

THE CHEMISTRY OF DIABETES MELLITUS.

By CHARLES T. KINGZETT, F.C.S. London and Berlin.

In the present article the writer proposes to briefly indicate what is known regarding the chemistry of the disease called "Diabetes Mellitus," and to consider the results obtained recently by Pavy in his researches.

In a work on Diabetes Mellitus, published by Dr. Rollo in 1798, is contained a most valuable mass of information concerning this disease, besides the description of many experiments with urine by Mr. Cruickshank, which, crude as they are in some respects, constitute indications of work which has been more elaborately wrought out since by other observers.

Rollo alleged that "this disease consists in an increased morbid action of the stomach with too great a secretion, and an alteration in the quality of the gastric fluid, producing saccharine matter by a decomposition of the vegetable substances taken in with the food, which remains unchanged." (Rollo on "Diabetes Mellitus," p. 387.)

This view of the disease he maintained against Dr. Baillie and others, who regarded it rather as consisting in a morbid state of the kidneys. But Dr. Rollo argued that the kidneys, from their structure, are incapable of forming sugar, while they simply act as separating agents, allowing that they might become morbid through the increased activity and sympathy they are subjected to in the disease. On this basis he explained the fact which he had recognised, that the serum of the blood contains, in cases of diabetes, less sugar than the urine. In consonance with these views sugar-forming foods were avoided in treating cases of this disease, while such oxidising agents as potassic chlorate and nitric acid were recommended, as bodies supposed to be capable of oxidising the sugar existing in the circulation.

Subsequently, Bernard and Hensen discovered in the liver a kind of dextrin of formula $C_6H_{10}O_5$, and they concluded that it was produced through a decomposition of albumen exerted through that organ. These views finally developed into a theory called "the glycogenetic function of the liver," which function was supposed to consist in the first place of the production of dextrin (glycogen) by the liver, and the transformation of this into sugar, which, passing into the blood by way of the hepatic vein, was supposed to become oxidised in the circulation during health. A lack of oxidising power was thus conjectured to constitute the disease, Diabetes Mellitus, so that the sugar is voided in its unchanged state. The above theory of Bernard and Hensen derived weight from the fact that dead liver is capable of quickly converting glycogen into sugar, and was upheld for many years by physiologists. Pavy—one of its chief admirers—nevertheless was the first to reject it as erroneous, and on the grounds that, according to him, no sugar is made in the liver in health. As some sugar could be found in hepatic blood, Pavy's experiments were criticised, among others, by Thudichum, who claimed to show that "they admitted of such variation as to prove either his or Bernard's doctrine" ("Chem. Phys.," Thudichum, p. 8).

Before considering Pavy's more recent researches let us now briefly notice some experiments which were conducted by Dr. A. Dupré, and published in the *Practitioner*. These experiments were made with the view of testing the prevailing theory of diabetes, and consisted in the administration of known amounts of fruit sugar (in the form of honey) to a diabetic patient, and in the estimation of the amount of the sugar passed in the urine. The quantitative determinations were effected in the ordinary chemical way, and were supplemented by optical determinations, by which he showed that all the fruit-sugar contained in the honey *administered* was oxidised in the system.

Mr. Abernethy had observed that sugar (of an uncertain quality) as food increased that voided in the urine, but this must be accepted as meaning *much* sugar given as food, for, as we have seen, up to a certain amount, that which is administered is oxidised in the circulation.

From Dupré's experiments we can almost conclude that diabetes is not to be explained as due to a lack of oxidising power in the blood. But Dr. Dupré went further than this: he thought his results pointed to the conclusion "that the sugar found in the urine has not previously existed ready formed in the blood, but has been formed only in its passage through the kidneys."

The first of these conclusions is, we think, supported by Bernard's own observation, that an artificial diabetes (glycosuria of Pavy) can be developed in dogs or rabbits by irritation with a needle of the fourth ventricle of the brain, whereby, after some time, sugar is developed in the blood and in the urine.

The second conclusion may derive some slight support from Lehmann and Dupré's observations, that the percentage of sugar found in the blood is extremely small, and generally amounting to 0·04 per cent only, a quantity not easily comparable with that which is excreted in the urine. But while this conclusion derives such a measure of support, it must be observed that it is in opposition to all our knowledge of the functions of the kidneys. Moreover, there are cases on record in which the sugar present in diabetic blood exceeded this amount: thus Dr. Thudichum found in one case as much as 2 per cent of sugar in the blood.

Now thus far we have only regarded the production of sugar as a factor in the disease, while Dupré observed that the administration of sugar as food caused a perceptible decrease in the amount of urea excreted, a fact also previously observed by F. Hoppe (*Arch. f. Path. Anat.*, x., pp. 144 to 169). Moreover, there are other evidences of a perversion of chemical agencies, consisting in the alleged appearance of lactic acid in the saliva, and of aceton in the stomach and the urine, the latter statement having been quite recently re-asserted. But the statement of the presence of aceton in the stomach, &c., must be accepted with caution, as the tests which have been adopted for its detection are also tests for *alcohol*.

With these data before us let us now consider the more recent researches of Pavy, "On the Production of Glycosuria by the Effect of Oxygenated Blood on the Liver" (*Proc. Roy. Soc.*, vol. xxiii., p. 539, and vol. xxiv., p. 51). simply premising that in a previous communication he had shown that "division of certain parts of the sympathetic system occasioned the presence of sugar in the urine."

Here Pavy first condemns, on the basis of experiment, Schiff's hypothesis, in which the escape of sugar from the liver, and thence the production of glycosuria, are supposed to be caused by the development of a ferment in the blood flowing to the liver, as a result of the hyperæmia which succeeds those operations on the nervous system which give rise to artificial diabetes.

Pavy next treats of the influence of arterial blood upon the liver, and demonstrates that sugar is developed in the circulation. In three experiments upon dogs defibrinated arterial blood was injected in the mesenteric vein, successful results being obtained in all instances where the amount of sugar in the urine was from 10 to 15 grains per fluid ounce. Having next shown that defibrinated *venous* blood failed to give these results, he explains the production of glycosuria through influences on the nervous system as due to a vaso-motor paralysis affecting the vessels of the chylo-poietic viscera, by which means the blood reaches the portal system without having been de-arterialised.

Pavy then supports his conclusions by causing animals to breathe oxygen, and he states that in *several* experi-

ments upon dogs saccharine urine was developed, while in the others no success was attained. In the case of frogs many experiments gave negative results, while some gave distinctly affirmative results. He also finds that artificial respiration with *air* is sufficient to cause glycosuria, an observation previously made—as indeed Pavy points out—by Tieffenbach.

Now Dr. Richardson had already alleged a similar result to be effected by the inhalation of carbonic oxide, and Pavy follows this with a parallel in the use of puff-ball smoke, which has been stated to owe its influence to the presence of carbonic oxide. This, however, is very doubtful, for the physiological effects of pure carbonic oxide and puff-ball smoke are vastly different in many respects.

Having thus shown that "the passage of oxygenated blood through the liver excites the transformation of its amyloid substance into sugar," he proceeds to attempt an explanation, and confesses that while he looks upon the production of sugar as only one part of the event occurring, he *thinks* the effect is due to the action of the oxidised blood as a ferment, and not to the direct influence of oxygen; and seeing that carbonic oxide combines with hæmoglobin (hematocrystalline), he reasons by analogy to the same conclusion as regards the way in which it produces glycosuria.

Pavy observed that the decoction of the liver, which is ordinarily milky from the presence of amyloid substance, became, under the influences described, nearly or quite clear, showing that this substance had disappeared, and passing on from this he adduces evidence from the observations of Dr. M. Foster, Bernard, and himself, that in several forms of life (Entozoa, larvæ of flies, solidified lung of pneumonia) amyloid substance accumulates in certain animal structures which have this feature in common with the liver, namely, a limited supply of oxygen.

While we desire to express our admiration of Pavy's elaborate researches, perhaps we may be pardoned for venturing a few criticisms on his conclusions.

Pavy is credited with having shown that temporary glycosuria can be induced by *impeding* respiration. Now, unless it can be shown that in such an instance blood reaches the liver in an arterial condition, such a result would be directly opposed to the experiments he has more recently performed and irreconcilable with the conclusions drawn therefrom. Moreover, Pavy's *explanation* of glycosuria is, we think, rendered somewhat doubtful by the fact that carbonic oxide acts like oxygen; for if oxygen gives rise to a ferment so also must carbonic oxide, and the two cannot be identical, hence the production of glycosuria must be brought about in a different way in each instance, and, moreover, such cases of artificial diabetes must differ very much from cases of natural diabetes.

We would further suggest that Pavy's conclusions can be experimentally criticised as follows:—If glycosuria be due to the transformation of amyloid substance into sugar, through the agency of a ferment present in oxidised blood, then if this dextrin-like body be isolated (as it can be), and treated with arterial blood out of the body, it should give rise to the formation of sugar. The same is to be said of carbonic oxide. The results of such experiments the writer hopes to be shortly in the position to publish.

This much seems to be certain, that glycosuria is not the result of the direct action of oxygen, for otherwise it would be difficult to explain how carbonic oxide should cause identical results. Moreover, it is not easy to see how a body of the formula $C_6H_{10}O_5$ can become converted into sugar, $C_6H_{12}O_6$, by an act of oxidation. Such a conversion can only come about by fixing a molecule of water, and this can be done through the agency of ferments, or an acid, or an alkali. Pavy concludes his last paper with these words:—"I consider that another link has been added to the chain of evidence against the glycogenic theory, which I have never wavered in regarding as untenable since the communication of my former researches to the Royal Society."

Here Pavy takes, we think, a perfectly justifiable position so far as regards that part of the glycogenic theory which states that in health the amyloid substance in the liver is transformed into sugar and thrown into the circulation, where it becomes oxidised; but until evidence touching the points we have raised is forthcoming it is difficult to accept Pavy's explanation of glycosuria, while, as regards the natural diabetes, his researches leave us in our old position, in which there is "neither a plausible theory nor a rational treatment of diabetes."

In concluding this contribution to the subject of diabetes we would make a few general comments.

Organic diseases affecting the brain and spinal cord, external injuries to the brain, and certain influences on the sympathetic nervous system, are known often to precede diabetes, and perhaps to lead to it, and these observations, supplemented by our knowledge of Bernard's famous experiments, and the skilful ones of Pavy, would seem to indicate that diabetes is a factor concerned in the chemical functions of the blood as governed solely by the nervous system. It becomes, therefore, especially valuable to investigate the brain and other parts of the nervous system in cases of death of diabetic subjects.

Finally, we would make a few remarks on a certain treatment of diabetes recommended and practised by Dr. Day, of Geelong. He has applied peroxide of hydrogen in cases of diabetes, as well as gout and rheumatism, believing all these diseases to be results of imperfect oxidation of the blood. He states that this treatment is efficacious through the oxidation of sugar effected, although he finds it to be successful only to the extent of giving relief and stopping the constant excessive passage of urine, while it fails to eradicate the causes of the diseases. Now I am not at all prepared to say that in the blood sugar cannot be oxidised by peroxide of hydrogen, but it is certainly impossible in the case of urine, for in an experiment the writer conducted it was found that the amount of sugar present in a sample of diabetic urine was the same after as it was before treatment with a great excess of this reagent. But there is this difference, that when blood is treated with peroxide of hydrogen nascent oxygen is immediately set free, but not so with urine. But notwithstanding this it is at least evident that Dr. Day's explanation of the good results attending the use of peroxide of hydrogen is faulty, for assuming for the moment that peroxide of hydrogen can oxidise the sugar present in diabetic blood, the quantity administered is not, nor can be in any sense, equivalent to the amount of sugar.

Footnote to the Preceding Paper.

In the above article the writer has spoken of "Diabetes Mellitus" as if it were a perfectly defined disease which reveals itself always according to a fixed state of things. But this has been done only for the sake of convenience in comparing it with "glycosuria." The natural disease seems to exist in many forms: these forms may or may not be related to the same original causes.—C. T. K.

Pathological Laboratory,
68, Earl's Court Road, Kensington, W.
April, 1876.

ON SOME REACTIONS OF IODINE AND PALLADIUM CHLORIDE WITH POTASSIUM FERROCYANIDE.

By SERGIUS KERN, St. Petersburg.

Iodine in the form of an alcoholic solution was added to an aqueous solution of potassium ferrocyanide (K_4FeCy_6); it dissolved in the liquor, which retained its original yellowish colour. Palladium chloride was next added, in order to separate the iodide of palladium in case the iodine occurred in the liquor in free state, but no precipitate of PdI_2 was obtained; the solution meanwhile turned brownish, and very quickly assumed a green tint. This

reaction shows the unfitness of palladium chloride in quantitative analysis for the separation of iodine from bromine and chlorine, because, if potassium ferrocyanide is present in the solution, faulty results may be obtained, as in this case iodine is not precipitated in the form of palladium iodide. The resulting greenish solution, on being boiled, yielded a solution of a beautiful dark green colour, which is palladium ferrocyanide ($PdFeCy_6$).

It was remarked during the experiments that iodine in lumps easily dissolves in a boiling solution of potassium ferrocyanide, the colour of which remains yellow.

In the green solution of palladium ferrocyanide obtained as mentioned above, the iodine dissolved in potassium ferrocyanide was not detected by starch; thus iodine must be supposed to be chemically combined with potassium ferrocyanide, and is, as I suppose, a molecular combination.

In the formation of palladium ferrocyanide iodine has no action, because the same green solution of this salt is obtained by adding palladium chloride to a solution of potassium ferrocyanide free from iodine.

Potassium hydroxide in the form of an aqueous solution, without being heated, rapidly dissolves the palladium ferrocyanide, yielding a yellow solution, containing free $KyFeCy_6$.

It must be mentioned that bromine easily dissolves in a solution of potassium ferrocyanide, forming a molecular combination.

In a solution of potassium ferricyanide (K_3FeCy_6) iodine also dissolves, yielding a reddish yellow liquor: in this solution palladium chloride does not give the palladium iodide, and does not yield the green palladium ferrocyanide; the liquor remains reddish yellow; potassium hydroxide colours this solution red.

These experiments prove that palladium salts must be very carefully used in analyses for the detection of iodine, because in presence of potassium ferrocyanide or potassium ferricyanide the iodine is not detected, and cannot be separated from bromine or chlorine by palladium chloride. So as gold salts give, with ferrocyanide of potassium, also a green colouration, the K_4FeCy_6 as a reagent may give faulty results, as it was remarked that palladium salts give the same colouration.

I conclude my paper by observing that if palladium salts are used as a reagent for iodine, the preliminary analysis must be very carefully executed, in order to be quite convinced of the absence of double ferrocyanates of potassium and other cyanides. As I showed in my paper in the CHEMICAL NEWS (vol. xxxii., page 242) that in presence of alkaline sulpho-cyanides ($KCNS$, NH_4CNS, &c.) iodine is not precipitated by palladium nitrate or chloride.

A SIMPLE METHOD F "NESSLERISING."

By OTTO HEHNER.

THE modification of Wanklyn's method of water analysis, or rather of the process of "Nesslerising," proposed by Mr. H. B. Cornwall, and described in the CHEM. NEWS (vol. xxxiii., p. 135), is far too lengthy and objectionable to be likely to supersede the process described by Wanklyn in his book on "Water."

I have, for some years past, been in the habit of employing a modification of the process of Nesslerising, much easier, I believe, shorter, surer, and less troublesome than the modification alluded to.

Two glass cylinders, capable of holding about 110 c.c., are graduated from below upwards, from 5 to 5 c.c., up to 100 c.c. The divisions must be equal throughout the whole length of the cylinder, ensuring perfect uniformity in the shape of the vessel. A glass tap is fused at about the division 30.

Cylinder A is filled to the 100 division with the distillate, and 2 c.c. of Nessler's reagent are added. The liquid therefore reaches to 102. Into the second cylinder as many c.c. of standard ammonia solution are run as will be deemed requisite to give a colouration equal to that yielded by the distillate, pure distilled water is used to fill up to the 100 mark, and 2 c.c. of Nessler, thus making the level of the liquid also in this cylinder B to reach 102.

The usual time is allowed to elapse before the tints are compared. Supposing the liquids to be of different depths of colour, the glass tap of the cylinder which contains the darker liquid is opened, and some of the liquid is allowed to run out quite slowly, while the observer looks down the tubes in the direction of the axis, towards a sheet of white paper. The colours will get more and more of the same shade and tint, till at last no more difference can be observed. The glass tap is now closed, and the division is read off. It is easy to calculate now the quantity of ammonia actually present in the distillate.

Supposing cylinder A, containing the distillate, appear the darker, and into B 5 c.c. of standard ammonia have been run, the liquid in both having been made to reach 102 as described, and, after equalisation of colours, the height of liquid in A was 76. We have then—

$$76 : 5 = 102 : x \; ; \; x = 6{\cdot}71 \text{ c.c.}$$

Supposing, on the other hand, that too great a quantity of standard solution has been put into B, and the level of the liquid in that cylinder, after equalisation, be 76: then we have—

$$102 : 5 = 76 : x \; ; \; x = 3{\cdot}72 \text{ c.c.}$$

If the distillate amount altogether to 163 c.c., then the whole of it contains as much ammonia as corresponds to—

$$3{\cdot}72 \times 1{\cdot}63 \text{ c.c.} = 6{\cdot}06 \text{ c.c.}$$

One single experiment thus gives accurately the quantity of ammonia. There is no difficulty whatever in noticing the right point, and, since the observer looks straight down the tube (not, as Frankland recommends, obliquely), the sinking of the level, whilst the tap is open, cannot be noticed at all, and no inconvenience can arise from the different height of the columns of liquid in the two cylinders.

Of course, after the right number has thus been found, a supplementary experiment *may* be made, adding the correct volume of standard ammonia to the pure distilled water in B; but in all cases the figures will agree within 1-10th c.c.

These graduated cylinders with glass taps may be procured, I believe, from Messrs. Townson and Mercer, Bishopsgate Street, London. Care should be taken to have them perfectly cylindrical, in order to ensure equal value of the different divisions.

The same method as described may be used in all other chlorimetric estimations, as of lead and iron in water, of copper, &c.

AN ESTIMATION OF THE FREE AND ALBUMINOID AMMONIA YIELDED BY THE STAGNANT WATERS OF THE DUBLIN STREETS, AS COMPARED WITH THE QUANTITIES OF THOSE SUBSTANCES OBTAINED FROM THE LIFFEY WATER, AFTER RECEIVING THE SEWAGE.*

By LANCELOT STUDDERT, LL.D, Ex-S. T.C.D.

DURING the Session of 1874-5 of the Royal College of Science, Stephen's Green, several examinations were made there of Dublin well-waters: and also some determinations like those that follow for the river water. As a sequel to those analyses, the suggestion of the Professor of Chemistry in that college, Mr. Galloway, induced me to undertake a series of estimations of the ammonia yielded by the surface-water of some streets and squares

* Read before the Royal Irish Academy, January 10, 1876.

in Dublin, taking as the standard of comparison the water of the Liffey, near where the sewage is discharged into the river.

The results of my examination, conducted during November and December last, in the College of Science Laboratory, are now laid before the Royal Irish Academy.

Altogether twenty-nine of these street-waters were examined; the samples dealt with were collected in my presence at the times and places stated in the Table appended to this paper: the mud, also, left from some of these pools was examined for ammonia, which reached two parts in the hundred, calculated after allowing for moisture expelled at 212° F. The river water was collected at intervals during the two months from four different places, namely at Eden Quay, Aston's Quay, Burgh Quay, and Sir John Rogerson's Quay, four hours after high water at Dublin bar.

The method employed for determining the quantity of ammonia yielded by these waters and muds is that devised by Messrs. Wanklyn and Chapman. This process is almost universally allowed to be the best yet made known for ascertaining the character of the nitrogenous matter in waters; its quantitative results are accurate, and they are obtained with rapidity. It may be well to state for the information of any unacquainted with the Wanklyn and Chapman process, that under the term "*free ammonia*," those chemists include ammonia, not only present *as such*, or in combination with acids, but also the ammonia that, after adding a saturated soda carbonate solution, is evolved by distillation from urea, or other easily decomposable nitrogenous organic bodies. The term *free ammonia* is therefore not strictly correct; but, taking it in this special sense, it would be difficult to substitute any other term more convenient or less open to objection.

The Table of results gives the figures for the Liffey standard at the head of the list. The quantities of the free and the albuminoid ammonia obtained from the several street and Liffey waters are calculated as grains in the gallon, and also as milligrms. in the litre of each water, respectively examined.

The average of free ammonia from the four samples of the river is 0·0982, or under $\frac{1}{10}$ of a grain in the gallon; the average of albuminoid ammonia from the same is 0·0779, or under $\frac{1}{13}$ of a grain in the gallon.

Date of Water Collection.	Place of Water Collection.	Free Ammonia. Grains per Gallon.	Free Ammonia. Milligrms. per Litre.	Albuminoid Ammonia. Grains per Gallon.	Albuminoid Ammonia. Milligrms. per Litre.
1875.	LIFFEY STANDARD.				
November 11	Eden Quay	0·0840	1·20	0·0980	1·40
„ 29	Aston's Quay	0·0812	1·16	0·0910	1·30
December 15	Burgh Quay	0·1750	2·50	0·0875	1·25
„ 17	Sir J. Rogerson's Quay	0·0525	0·75	0·0350	0·50
	Total	0·3927	Total	0·3115	
	Average	0·0982	Average	0·0779	
November 1	Stephen's Green, N.	0·1260	1·80	0·2380	3·40
„ 2	„ E.	0·0700	1·00	0·4200	6·00
„ 3	„ S.	0·0700	1·00	0·3780	5·40
„ 5	„ W.	0·3150	4·50	0·4900	7·00
„ 15	Stephen's Street, Lower	12·6000	180·00	5·8000	80·00
„ 17	Cross Kevin Street	2·8000	40·00	1·4000	20·00
„ 18	Patrick Street	4·9000	70·00	1·7500	25·00
„ 19	Townsend Street	4·5500	65·00	4·9000	70·00
„ 20	Peter Place, at corner on Adelaide Road	5·6000	80·00	10·1500	145·00
„ 30	Baggot Street, Lower	0·7000	10·00	0·8000	12·00
December 1	Duke Lane	1·1900	17·00	1·1900	17·00
„ 1	Lemon St. (late Little Grafton St.)	9·1000	130·00	2·0300	29·00
„ 2	Leeson Street, Lower	1·5400	22·00	0·9100	13·00
„ 2	Leeson Lane	10·5000	150·00	2·3800	34·00
„ 7	Creighton Street	1·5400	22·00	0·9800	14·00
„ 7	Sandwith Street	1·8200	26·00	1·4000	20·00
„ 7	Boyne Street	4·2000	60·00	2·1100	31·00
„ 8	Abbey Street, Mid.	3·7800	54·00	1·8200	26·00
„ 10	Lee's Lane, Aston's Quay	98·0000	1400·00	11·2000	160·00
„ 10	Sir J. Rogerson's Quay, *Gutter*	70·0000	1000·00	7·0000	100·00
„ 10	Moss Street	105·0000	1500·00	10·0000	145·00
„ 10	Poolbeg Street	105·0000	1500·00	7·0000	100·00
„ 14	Peterson Lane	9·8000	140·00	0·9800	14·00
„ 15	Frederick Lane, S.	7·0000	100·00	1·8200	26·00
„ 17	New Street	13·5000	150·00	3·5000	50·00
„ 20	Fitzwilliam Square, W.	0·4900	7·00	0·3500	5·00
„ 20	„ E.	17·5000	250·00	1·7500	25·00
„ 20	Merrion Square, N.	0·3500	5·00	0·5250	7·50
„ 20	„ S.	0·4200	6·00	0·2800	4·00
	Total	492·8610	Total	83·6460	
		Average 17 grs. of free ammonia per gal. of water (surface).		Average 3 grs. of albuminoid ammonia per gal. of water (surface).	

Mud dried at 212° F. Percentage.

	Free Ammonia.		Albuminoid Ammonia.
Peter Place Corner	1·2857	+	0·6163 = 2 per cent
Lower Stephen Street	0·3780		0·1001
Boyne Street	0·4861		0·3640

It may be interesting to note that the examination of the river water referred to as having been made by other workers in the College of Science Laboratory, in 1874, gave a result equal to my average in 1875; thus showing a remarkable constancy in the state of the Liffey.

It may also be remarked in passing that my average for free ammonia is less, but for albuminoid ammonia is greater, than the average Messrs. Wanklyn and Chapman reported as that of the Thames at London Bridge, in June, 1867: that river, the tide being at two hours flood, yielding free ammonia =0·1232 of a grain per gallon; and albuminoid ammonia =0·0245 of a grain per gallon.

The average of free ammonia obtained from the 29 street-waters is 17 grains to the gallon, that is, over 170 times the like average from the river. The average of albuminoid ammonia from the street-water is 3 grains to the gallon, or 38 times the Liffey average.

It will be seen by the Table, that from three out of the four river samples, the quantity of free ammonia was under that yielded by any of the street-waters, except at Stephen's Green, East and South.

The maximum of free ammonia from the river was at Burgh Quay, and only reached 0·175, or less than $\frac{1}{5}$ of a grain to the gallon; whilst the maximum of free ammonia from the street-waters, namely, at Moss Street and Poolbeg Street, was 105 grains to the gallon, that is, exactly 600 times greater than the river maximum.

The *least* impure of the 29 street-waters yielded nearly three times more albuminoid ammonia than the *most* impure sample of the river water; for instance, the surface-water at Merrion Square South being the best of the street-waters, yielded 0·280 of a grain against that obtained from the river at its worst, namely, 0·098 of a grain, or nearly 3 to 1.

But the bad pre-eminence of the water in Moss Street and at Peter Place (corner in Adelaide Road), and in Lee's Lane, off Aston's Quay, namely, 10 and 10·15 and 11·2 grains of albuminoid ammonia from one gallon of each water, respectively, is more than 100 times greater than the Liffey maximum.

Messrs. Wanklyn and Chapman conclude from a wide induction of experiments that "the disintegrating *animal refuse* in the river [Thames] would be pretty fairly measured by *ten times* the albuminoid ammonia which it yields." In this way, the average of such refuse in the Liffey is 0·779, or just $\frac{3}{4}$ of a grain in the gallon; whilst the average of such refuse in the street-waters is 29 grains to the gallon.

That much of this enormous amount of animal matter thus in our midst must, if not rapidly removed, take forms that will vapourise, seems all but certain, since the conditions for spontaneous decomposition may be said to be always present; there are the moisture and heat required for this chemical change, and then there occurs at intervals the drying up of these stagnant pools.

My examination of these street-waters found, as might be expected, sulphuretted hydrogen, with other sulphides and very offensive volatile substances.

What the effect must be on the people's health who dwell in an atmosphere contaminated by exhalations such as these, it is not for me to determine; this paper simply records the facts of the case, leaving conclusions to those physicians who make such researches their peculiar study. But without knowing the least of the little that is known, even to the medical faculty, about either the chemical or the germ-theory as to the propagation of disease, yet one of the unlearned, like myself, having but ordinary sagacity, might correctly conclude that the continued presence of so much dirt in the streets would go far to account for the high death-rate (33 to the 1000 yearly) lately recorded for Dublin, a city whose situation, other things being equal, might mark it out as one of the healthiest in the Empire. The London *Times*, reviewing "Ireland at the close of 1875," laid this to our charge—that "dirt reigns, and slays its thousands in Dublin and elsewhere."

Whatever is to be done with our street sewage, whether it is still to defile the natural purity of the river, or to be applied to improve the land, or only to be thrown away, with great cost, into the sea; whatever be the destination of this noxious mass, whether it is to be good, bad, or indifferent, it certainly appears, from the results now laid before the Academy, that better scavenging and a level surface for the streets is at once required.

The Professor of Hygiene and Public Health in University College, London (Dr. Corfield), in reference to this subject, in the "Manual of Public Health," edited by Hart, states that:—"If the streets, roads, and ways of a town or district are allowed to become or to remain so out of repair as to become receptacles for filth, or to afford, by their inequalities, depressions in which foul water accumulates, it is in vain to look for beneficial results from other sanitary measures."

REPORT

ON THE

DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

Progress in the Artificial Production of Cold and Ice.

By Dr. H. MEIDINGER.

(Continued from p. 177.)

ACCURATELY regarding the various stages traversed by the air, the arrangement of an air ice machine would be, in principle, as follows:—The air is condensed in an especial cylinder up to a certain pressure, at which it is then forced into the cooling apparatus. Whilst it here parts with its excess of heat, its volume, at the same pressure, becomes reduced in the proportion—

$$\frac{273+t}{273+T}.$$

Hence it passes into a second cylinder where expansion takes place; the processes taking place here in the reversed order from what ensues in the compression cylinder, and the effect agrees exactly with that of an expansion steam-engine. The air here becomes very cold and is forced by the return of the piston into the freezing chamber where the ice boxes stand. After passing through this apparatus it arrives anew in the compression-cylinder to repeat the same circuit. The expansion-cylinder here corresponds to the evaporation-receiver in other machines. The distinction, however, must be noted that but a small quantity of air is kept in circulation, whilst in other systems a large stock of the matter inducing the cold is present in the state of a liquid. It will be seen that the course of the conversions is exactly the same as in a "caloric engine," but in a reversed direction, and the performance of the one and the other may be calculated by the aid of the same formulæ. The writer has carried out such a calculation,† from which, it appears, that when the air, at an initial temperature of 20° C., is compressed to 3 atmospheres and then cooled down to 30°; the theoretical yield is 5 kilos. of ice per 1 kilo. coal consumed, whilst at 2 atmospheres the yield is 6 kilos. The production is in general terms inversely as the condensation of the air or the difference of temperature thereby produced. But, on the other hand, the dimensions of the cylinders for a given yield must be so much the larger the smaller the condensation which is to be applied, as appears at once on a close examination of the procedure. The actual performance of the machine may perhaps be considered equal to one-half of the theoretical yield. Hence it appears that the air machine is far

* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzeends."

† *Bad. Gewerbz.*, 1869, Appendix Number.

inferior in its performance to the ammonia machine.* The reasons are the same which have been already advanced in the comparison of the ammonia and the ether machine. The efficacy of the machine may, however, be considerably increased, if, as we shall further explain below, the air is at once cooled during compression, so that it cannot become heated, in which case the cost of compression is much reduced. An advantage of the air machine as compared with other systems is that no offensive or combustible substances are brought into play, and that there can occur no waste of a costly material.

An air machine is mentioned for the first time in 1863.† It was patented in England in April, 1862, by A. C. Kirk, of Bathgate. It consists of upright cylinders, the lower part of each being connected with the upper part of the other by a channel, fitted with a valve opening upwards. The pistons have valves opening downwards. The lower covers of the cylinders are kept cold by a stream of water, whilst the upper give off cold to salt water. According to the somewhat obscure description the action is as follows:—The piston of the cylinder *a* on descending compresses the air below it, and expands that above it, the compressed air being forced into the upper part of the cylinder *b*. On the ascent of the piston *a* the expanded air passes through the valve of the piston from the upper into the lower part of the cylinder, whilst the piston receives above at first compressed air from the lower part of the cylinder *b*, which, when the latter is emptied, begins to expand and to be cooled. The same processes take place in the cylinder *b*. Consequently one and the same quantity of air is always employed, which circulates from one cylinder to the other. It is asserted that 1 horse-power yields, in twenty-four hours, 106 kilos. of ice, the yield of the ether machine being 110·5 kilos., =2 kilos. ice per kilo. of coal. In Young's paraffin works at Bathgate there was at that time a machine which turned out in twenty-four hours 2 tons or 2032 kilos. of ice. The result is somewhat small; the cooling surfaces of the cylinders are certainly not large enough to take up heat and cold quickly and completely. Indeed a series of theoretical objections might be urged against the construction of the machine, which is very simple. In 1864 it was announced that this machine was still at work in Young's establishment, producing a ton of ice with the consumption of a ton of coal, worth (then) four shillings. It was also declared that its efficacy was equal to that of the ether machine.‡ This would be a far smaller yield.

(To be continued)

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Friday, April 28th, 1876.

Professor Abel, F.R.S., President, in the Chair.

At this meeting (which was a special one) Professor Andrews, F.R.S., delivered a lecture "*On Certain Methods of Physico-Chemical Research.*" After a few preliminary remarks, in which he observed that the address must necessarily be of a somewhat discursive nature, he exhibited and described the apparatus employed by him many years ago for determining the heat developed during the combination of gases. It consisted of a thin copper cylinder, into which the mixture of hydrogen with excess of oxygen was introduced, closed by a screw top, with an apparatus attached for igniting a fine platinum wire in the interior of the vessel by means of an electric current. This was placed in a calorimeter, and the whole in a copper box, where it could be rotated so as to equalise the temperature of the water. After the rotation the temperature of the calorimeter was taken, the explosion effected, the apparatus again rotated, and the temperature read a second time, giving, after the necessary corrections had been made, the heat developed by the union of the known quantity of hydrogen with water in the proportion to form water. For the combustion in oxygen of solids, such as sulphur or carbon, a somewhat similar but larger apparatus was employed. The only experiments yet made to ascertain the heat developed by the direct combination of chlorine, bromine, and iodine had been made by him. He had at first experienced some difficulty in the case of potassium, as no glass vessels would resist the heat developed by its union with chlorine. This difficulty had been overcome by using a brass vessel, for he had found that dry chlorine was without action on both copper and brass. He also stated that in determining the heat developed by the mixing of liquids the only method of obtaining accurate results was to float a thin glass or platinum capsule containing one of the liquids on the surface of the other, and then by means of a fine pair of forceps pour out the contents of the capsule. Thomsen's results, obtained by another method, although not absolutely correct, were more accurate than those of Favre and Silbermann. Although frictional electricity was competent to decompose potassium iodide, yet it had been found that on passing the current by means of platinum electrodes through acidulated water no trace of gas was evolved: the wires became polarised, however, from which it might be inferred that the water was actually decomposed. It had seemed to him that the non-appearance of gas at the poles was due to its being dissolved in the large bulk of the liquid used, and he had consequently devised a simple arrangement by which this inconvenience might be avoided. Long platinum wires to serve as electrodes are fused into the ends of a couple of thermometer tubes, which are then filled with acidulated water by the simple expedient of boiling them for some time in the liquid. They are then inverted in a vessel of the same acidulated water, and a current of electricity from an electrical kite passed through by means of the platinum wires. In this way it was found that the water was quickly decomposed, and owing to the great tension of the electricity fifty or sixty of these couples could be arranged in series without any sensible diminution in the rate of decomposition, whilst it was well known that two or three, when introduced into the circuit of an ordinary battery, greatly enfeebled if it did not entirely stop the current. If one of these tubes filled with oxygen were placed over a solution of potassium iodide, and the silent discharge passed, the whole of the gas would be absorbed in about a minute. He desired particularly to draw attention to these tubes as affording a facile mode of experimenting on the action of the electric current on gases and liquids. He also exhibited the tubes employed by himself and Prof. Tait in their experiments to demonstrate the diminution in volume which oxygen undergoes when converted into ozone. They consist of a wide tube filled with oxygen, and furnished with platinum wires, which is connected with a small U-tube containing concentrated sulphuric acid to serve as a gauge. After the oxygen had been measured at a constant temperature the point of the gauge was sealed, the discharge passed, and the apparatus brought to the original temperature. On now breaking off the sealed point of the gauge the

* In consequence of the low specific heat of the air, relatively large quantities must be employed, whence the cylinders and the resistance of friction to be overcome are very large.

† *Pract. Mech. Journ.*, 1863, 113. *Dingl. Pol. Journ.*, clxx., 241. Wagner, *Jahresbericht*, 1863, 568. However, a patent for an air ice machine was granted in England to one Nesmond, of Bellac, in France, as early as 1852. It compressed air to 20 atmospheres by means of a hand air-pump in a vessel like a boiler placed in cold water. After cooling the air passed into a second vessel where were the substances to be cooled or the air to be frozen, and escaped thence into the open air. It was asserted that a man could force the air into the compression-vessel in eight minutes, and thus produce 8 to 10 lbs. ice per hour. The action of the apparatus was therefore intermittent and not economical, and indeed the whole arrangement left much to be desired in point of convenience.

‡ *Mech. Mag.*, 1864, 245. *Dingl. Pol. Journ.*, lxxiv.

diminution of volume could readily be observed; and if again sealed and heated to 300° C., and the volume again observed with similar precautions, it was found to be what it was originally, the ozone having been reconverted into oxygen. An apparatus on the same principle, but on a larger scale, adapted for class experiment, was shown in action. It consists merely of a Siemens's induction tube filled with oxygen, and connected with a narrow tube, the end of which dips into concentrated sulphuric acid, so as to serve as a gauge to measure any alteration in volume. As soon as the temperature of the apparatus has become constant, and the column of sulphuric acid in the gauge-tube is stationary, the silent discharge from an induction coil is passed. The first effect, from the elevation of temperature, is to expand the gas and cause the column in the gauge to sink. After a time, however, the column begins to rise, showing the contraction in volume of the oxygen produced by the conversion of a portion of it into ozone. It seemed unlikely that this property of the silent discharge of altering the density of oxygen should be confined to that element, and he had tried its effect on nitrogen and chlorine, but with negative results. He had hoped for something different in the case of chlorine, for it was a curious fact that although platinum might be left for years in contact with chlorine without producing any effect on the metal, yet it was immediately attacked when an electric current was passed. The Lecturer then passed on to his apparatus for determining the latent heat of vapours, pointing out the great advantage of having it of small size, since the experimenter was thereby enabled to work with small quantities of material, for they all knew how extremely difficult it was to obtain liquids which were perfectly pure in quantity. He was in the habit of passing the vapour of the substance directly from the vessel in which it was dried over calcium chloride, so as to avoid any chance introduction of a trace of water, a matter of the utmost importance when the high specific heat of water is considered: 1 per cent of water in a liquid would often cause an error of 10 per cent in the latent heat. The determination of the latent heat of vapour was a very large field for chemists to work in, as at present scarcely anything had been done in it. After some remarks on the construction of graduating engines, in which he recommended the use of a very short screw, it being impossible to obtain a long one which was perfect, he proceeded to describe the construction and methods of working with his apparatus for observations on the behaviour of gases under great pressures. The thermometer-tubes employed in these experiments are made of a special kind of glass, and joined at one extremity to a wider tube, which is cut off and ground at the end. A slight swelling is made in the thermometer-tube towards the lower end to serve as a shoulder, on to which and for some distance down the tube shoemaker's thread is wound and covered with cobbler's wax, so that when firmly pressed into the perforated gun-metal cover of the pressure apparatus it forms a perfectly tight joint. The lower end of the tube dips into a glass vessel containing mercury, and the upper one, after the gas has been introduced, is carefully sealed. The accurately graduated and calibrated tubes are filled by passing a current of the pure dry gas, carbonic anhydride for instance, through them for some hours. The end is then carefully sealed, so as to cause the bore to be as perfectly conical as possible. This is a matter of considerable difficulty, but may generally be effected by keeping the tube vertical, and rotating it slowly before the blowpipe flame. The glass tube containing the mercury, and into which the lower end of this pressure-tube is plunged, is introduced into the gun-metal apparatus for communicating the pressure, and which is filled with water, the whole being screwed up tightly. The desired pressure is obtained by means of screws at the bottom of the apparatus, which being screwed into the water diminish the capacity of the vessel, the pressure thus produced being transmitted to the gas in the pressure-tubes through the mercury. In order to make these screws quite tight under the enormous pressures employed, sometimes reaching 500 atmospheres, they pass through washers consisting of a pile of discs of perforated leather, which have been saturated with grease by soaking them *in vacuo* in melted lard. In this manner the apparatus was still perfectly tight even after the lapse of two or three years. He might mention that he had an apparatus made of iron, in which the pressure was communicated to the gas entirely by means of mercury, but he never succeeded in getting it to remain perfectly tight for any length of time. The graduated portions of the thermometer-tubes projecting from the apparatus were surrounded by a suitable arrangement for keeping them at a constant temperature by means of a current of water, or steam, or the vapour of some other liquid. When employing steam he had at times encountered some difficulty from drops of water condensing on the graduated tubes, and thus interfering with the readings; these, however, could readily be removed by pouring in boiling water, which washed the tubes thoroughly. He had found great difficulty in employing the vapours of liquids other than water, owing to the impossibility of obtaining them in any quantity in a pure state so that they would boil at a constant temperature. He also described the means by which he had ascertained that mercury did not absorb either air or carbonic anhydride in the slightest degree, and mentioned that although under very high pressures the capacity of the tubes was slightly altered, such alteration was not permanent, and then proceeded to give a brief abstract of the results which he had just laid before the Royal Society at the Bakerian Lecture on the natural gaseous states of matter, and the way in which they differ from a theoretically perfect gas: the product of the pressure into the volume being invariably less than unity, whilst with a perfect gas it would be unity. It is thus shown that gases condense more than they would if Boyle's law were correct. After some remarks on the air-manometer, which he said was an almost perfect instrument up to 200 atmospheres, the Lecturer concluded amidst great applause.

The President then in a short speech expressed the thanks which they owed to Prof. Andrews for his most interesting lecture.

The Lecturer afterwards exhibited the striking experiment of the action of heat on liquid sulphurous anhydride in causing it to pass into that curious "intermediate state" in which it is neither liquid nor gaseous.

PHYSICAL SOCIETY.

April 29th, 1876.

Prof. Gladstone, F.R.S., Vice-President, in the Chair.

The following gentlemen were elected Members of the Society:—Prof. F. Fuller, M.A., and Capt. E. H. White.

The Secretary read a communication from Sir John Conroy, Bart., "*On a Simple Form of Heliostat.*" The defect of Fahrenheit's heliostat, in which the beam of sunlight is reflected by a mirror moved by clockwork in a direction parallel to the axis of the earth, and then in the required direction by a fixed mirror, consists in the great loss of light. The author substitutes two silvered mirrors for the looking-glasses usually employed, and he has shown that the loss of light with this arrangement is less than when the light is once reflected from a looking-glass.

Mr. S. P. Thompson, B.A., B.Sc., then made a second communication "*On the so-called 'Etheric Force,'*" and described some experiments which he has recently made in the Physical Laboratory at South Kensington on the subject. The name was given by Mr. Edison—the inventor of the motograph—to the sparks obtained when a conductor is presented to the core of an electro-magnet, the coils of which are traversed by an intermittent current. The results of the experiments conducted as originally described not proving satisfactory, various other arrange-

ments were tried, and it was found that if the secondary current from an induction coil be used instead of a current direct from the battery the effects are much more marked. When the induced spark was thus diverted, either wholly or partially, into a short coil which was insulated very perfectly from the core inside, a spark about half an inch in length, which has a decided effect on the nerves, could be drawn off from the core, and this was sufficient to illuminate a small vacuum tube; the spark, however, does not exhibit the usual signs of polarity. It was shown by observing the illumination thus produced with a rotating mirror, that the discharge is in reality a reciprocating one, each spark returning on its path after a minute interval of time. Under certain conditions it is also possible to charge an electroscope either positively or negatively by means of the spark, and Mr. Thompson has shown that the spark ignites a jet of gas, but fails to deflagrate metallic wire or ignite gunpowder. From the above and other experiments, which will be exhibited on a future occasion, the author concludes that the cause of the phenomena is obvious, and that the hypothesis of a new force is unnecessary.

Prof. McLeod referred to a paper on the same subject, which appeared in the Chemical News (vol. xxxiii., p. 173), by Professors Houston and Thomson.

Mr. David Ross, B.A., enquired the tension of the Leyden jar arrangement used in the experiments, but Mr. Thompson pointed out that it would be very difficult of determination on account of the rapid change of the spark from positive to negative.

NOTICES OF BOOKS.

The Journal of the Iron and Steel Institute. No. 2, 1875 London: E. and F. N. Spon.

This issue contains an account of proceedings at the meeting of the Institute at Manchester, in September last.

Of the papers read one only seems to come fairly within our cognizance, namely, an essay by Mr. I. L. Bell, F.R.S., on the use of caustic lime in the blast-furnace. The author shows that of the total heat generated 22 per cent was absorbed by the expulsion of carbonic acid from the limestone, and the decomposition of this compound of oxygen and carbon. Of this loss 16 per cent is due to the use of limestone. Hence he argues that:—"An expenditure of 16 per cent of the heating power of the fuel, which is rendered necessary by the presence of one of the constituent parts of our flux affords, *prima facie*, a strong reason why we should seek to relieve the furnace of a duty represented by about 4½ cwts. of coke, particularly as half this weight of inexpensive small coal sufficed for the purposes of the lime-kiln."

In certain experiments undertaken with furnaces 48 feet high he failed to find any tangible economy in fuel effected by the substitution of burnt lime for the raw limestone. In the same furnaces, however, he found an advantage in the increased make and superior quality of the iron when burnt lime was employed. With furnaces 80 feet in height this improvement was no longer to be traced. In the experiments undertaken with these furnaces the composition of the cinder in each case was found almost absolutely identical, and no change in the removal of silicon or sulphur from the metal was effected by the use of burnt lime.

Hence he concluded that in what he called an "imperfect furnace," *i.e.*, a furnace less than 80 feet high, there was certainly an advantage in using limestone in a calcined state. But in complete and perfect furnaces, where the economy of coke is carried as far as the chemical nature of the operation permits, there is nothing to be gained by a change.

Etudes sur le Phylloxera et sur les Sulpho-Carbonates. Par M. Dumas.

This treatise composes the seventh volume of the Fifth Series of the *Annales de Chimie et de Physique*, and embodies the labours of the special commission issued to investigate this minute but formidable enemy of the vineyards. The following are the conclusions arrived at:—As regards the phylloxera of the roots it is found that the sulpho-carbonate of potassium, of which more than 20,000 kilos. have been already used, is a rapid insecticide, the only one which certainly destroys the phylloxeras fixed upon the roots, and which affords at the same time an efficient nourishment to the vine. The sulpho-carbonate of sodium offers similar advantages as an insecticide only. The sulpho-carbonate of barium being an anhydrous salt, and sparingly soluble is recommended by its resistance to the action of oxygen and to that of carbonic acid, which renders it a poison less rapid, but of an effect more durable.

As to the winter-eggs the heavy oil of gas-tar, and especially the so-called oil of anthracen, seems to be the most suitable agent for anointing the branches and for destroying the winter-eggs. The application of gas-tar to the branches and of sulpho-carbonates to the roots is best performed in the months of February and March.

That the investigation has been carried out on truly scientific principles the name of M. Dumas is a sufficient guarantee, and the signal success which has been attained is a fresh instance of the practical value of seemingly abstract research, and of the efficiency of scientific method.

CORRESPONDENCE.

ON A NEW REACTION OF TARTARIC ACID.

To the Editor of the Chemical News.

I have lately noticed the following reaction, which, besides presenting one or two rather interesting peculiarities, may, as far as I can judge at present, be proposed as a test for tartaric acid. To a very dilute solution of ferrous sulphate or chloride, a small quantity of a solution of tartaric acid or a tartrate is added, followed by a few drops of chlorine water or hydric peroxide, and lastly, excess of caustic potash or soda, when a fine violet colour is obtained.

I have tried the same experiment, using citric, succinic, malic, oxalic, or acetic acids, or sugar, in place of tartaric acid, but without getting a similar result. If a ferric salt be used instead of a ferrous salt, the colour is not obtained. The violet compound formed appears to be potassic or sodic ferrate. It is destroyed at once by sulphurous acid, and is slowly discharged by boiling.

I have tried to obtain the higher oxides of manganese and chromium in the same way, but without success. I intend to follow up the investigation more fully.—I am, &c.,

H. J. H. Fenton.

Christ's College, Cambridge, April 25, 1876.

ORGANISATION AMONG CHEMISTS.

To the Editor of the Chemical News.

Sir,—I am glad to find that chemists seem to be waking up to the fact that they ought to have a position as members of an honourable profession. There is no doubt that it is a splendid science, and I regret much at the low tone that is taken by some of your correspondents.

Connected as chemistry is so closely with physics, medicine, sanitary matters, not to speak of the arts and manufactures, it seems to me a pity that anyone should

suggest that it is sufficient qualification to pass in inorganic chemistry alone: this can be learnt in a year, and I am quite sure that no one can learn chemistry in that time so as to be any credit either to himself or the profession.

There is no doubt that at present chemists are held in very low estimation, and there can be no wonder that in this great commercial country some are found to grumble at the very poor remuneration that is attached to it. This, however, is perfectly intelligible, as so few men study and qualify for it properly.

I must beg to differ from one of your correspondents, who says that it is "those who have a sufficient private income who degrade the profession by the acceptance of wretchedly low fees." It seems to me that very few men with a "sufficient private income" take up chemistry as a profession, and I wish there were more. With regard to "organisation," I think this might be more properly referred to the highest authorities in our profession, and I am glad to say I have good reason to believe that the Council of the Chemical Society is taking some steps towards distinguishing between those who are properly qualified and those who are not.—I am, &c.,

THETA.

May 2, 1876.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances, de l'Academie des Sciences. No. 15, April 10, 1876.

Experimental Criticism on the Formation of Sugar in the Blood, and on the Function of Physiological Glycæmia.—M. Claude Bernard.—The author maintains that the experiments, on the faith of which earlier authors have thought themselves entitled to deny or to affirm the presence of sugar in the blood of diabetic patients, have really no scientific value. The experiments of Tiedemann, Gmelin, and Magendie are exact as crude facts, but the interpretation which connects them with an amylaceous or saccharine diet is erroneous.

Analytical Solution of the Problem of Distribution in a Magnet.—M. J. Jamin.—A strictly mathematical paper, unfit for abstraction.

Vegetation of Maize begun in an Atmosphere free from Carbonic Acid.—M. Boussingault.—The author's experiment shows that a seed placed in a barren soil supporting a barren atmosphere forms at first, on germinating, a fertile atmosphere, that is to say, an atmosphere containing carbon, in which, under the influence of light, the leaves develop chlorophyll, and subsequently amylaceous and saccharine matters.

Verbal Observations on the foregoing Communication.—M. Pasteur.—We may comprehend that special cellules, animal or vegetable, other than those of chlorophyll may behave towards electricity as the cells of green matter behave with the solar radiations, and that the carbonic acid is decomposed and is carbon assimilated, because the electric vibrations are transformed into chemical force.

Seventeenth Note on the Electric Conductibility of Bodies Moderately Conductive.—M. Th. du Moncel.—Not suitable for abstraction.

Solar Spots, and on the Physical Constitution of the Sun.—M. G. Planté.—M. Planté concludes from his experiments that the sun may be considered as a hollow electrified globe, full of gases and vapours, and covered with a liquid covering of molten incandescent matter; the wrinkles, or luculi of his surface, result from undulation in this liquefied stratum; the spots are produced by masses of gas and electrified vapours proceeding from the interior of the orb, penetrating the liquid layer, and giving to the edges of the cavities forms which characterise the passage of positive electricity. The *faculæ* seem to be a brilliant phase in the evolution of the gaseous masses when they approach the surface before their eruption. The protuberances are formed by the gases themselves issuing from the interior of the sun at a higher temperature, and consequently more luminous than those which form the atmosphere of his surface.

Influence of the Asparagin contained in Saccharine Juices (Canes and Beet-roots) upon the Saccharimetric Assay: Destruction of the Rotatory Power of Asparagin, and Method for its Determination.—MM. P. Champion and H. Pellet.—The presence of asparagin in saccharine juices makes the percentage of sugar apparently too high, the error amounting in certain cases to 0·7 per cent. An addition of acetic acid destroys this disturbing influence.

Theory of Trial Contact.—M. Bouty.—A mathematical paper, not suited for abstraction.

Use of the Magneto-Electric Machines of M. Gramme for Lighting the Large Halls of Railway Stations.—M. A. Sartiaux.—Under the circumstances in question the electric light is not merely more intense but more economical than gas.

Simple Apparatus for the Analysis of Gaseous Mixtures by means of Absorbent Liquids.—M. F. M. Raoult.—This paper requires the accompanying illustrations.

Exchanges of Ammonia between Natural Waters and the Atmosphere.—M. Th. Schlœsing.—The quantity of ammonia condensed in each gramme of water increases as the temperature falls, in spite of the gradual impoverishment of the air.

Products of the Reduction of Anethol, and on the Probable Constitution of this Latter Body.—M. F. Landolph.—The author holds that the formula of anethol ought to be doubled.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

Improvements in the manufacture of manures. Major-General H. Y. D. Scott, C.B., Ealing, Middlesex. February 1, 1875.—No. 373. The object of this invention is the production from faecal matters of manures sufficiently concentrated to command a ready market without the creation of a nuisance in the process. Instead of employing deodorants of a bulky and (as respects fertilising properties) inert nature, I make use in some of the closets of coal soot which contains considerable quantities of ammoniacal salts, and in others I apply as a deodorant lime, which is subsequently neutralised with phosphoric acid in a soluble form combined or uncombined with a base. The combined matters are afterwards stirred in a pug-mill, and then dried and reduced to a powder.

Improvements in the treatment of farinaceous substances for the manufacture of starch and fermented and distilled liquors. J. H. Johnson, Lincoln's Inn Fields, Middlesex. (A communication from W. Adamson, Philadelphia, Pennsylvania, U.S.A.) February 2, 1875.—No. 381. The essential features of this invention consist in preparing farinaceous substances for conversion into starch, beer, or alcohol by subjecting them to the action of heated hydrocarbons or hydrocarbon vapour under heat and pressure.

Improvements in the process of and apparatus for treating and purifying sewage and polluted waters, which improvements are applicable for collecting the soap, grease, and oils for the manufacture of gas, and for removing incrustation in steam-boilers. G. Rydill, Quality Court, Chancery Lane, Middlesex. February 3, 1875.—No. 399. This invention of improvements is for the purification of sewage and polluted waters, preventing the pollution of rivers and streams, which improvements are applicable for collecting the soap, grease, and oils, which prevents insoluble soaps and slimy scum from mixing with the sewage waters in the sewers, which may be used for the manufacture of gas and other useful purposes. As the polluted waters are precipitated with an alkali, such waters after being purified may be used or steam-boiler purposes for removing incrustation.

Improvements in the treatment of saccharine solutions. J. H. Johnson, Lincoln's Inn Fields, Middlesex. (A communication from L

Marot, Paris.) February 3, 1875.—No. 408. The essential feature of this invention consists in raising the saccharine solutions to a boiling temperature, and then adding thereto or bringing the same in admixture in another vessel with a solution of lime or baryta, and then adding an alkali, either soda, potash, or ammonia, the same being by preference free from carbonates.

Improvements in furnaces used in the manufacture of glass. J. Shemield, Glasgow, Lanark, North Britain. February 4, 1875.—No. 411. The features of novelty which constitute this invention are—(1) The water tank at the sides of and below the fire-bars. (2) The empowerment of air, and heating it by tortuous passages in the sides of the "cupola." (3) Constructing tank-furnaces with an air space passing up through the "cave," so as to divide the tank, thus enabling two kinds of glass to be simultaneously treated in the same furnace.

A new and useful process in the manufacture of imitation braids, trimmings, leather, wood, and other articles. H. Loewenberg, Charlottenburg, near Berlin, Germany. February 4, 1875.—No. 420. This invention relates to the production of flexible or elastic casts in imitation of leather, straw, or woven goods, wood, ornaments, &c. A mould is first made of the object to be imitated by pouring over the same a compound, consisting by preference of a solution of glue with glycerin, which is removed after it has solidified. Into this mould is then poured a liquid compound, consisting of a solution of glue with glycerin, oil, or soap, and any desired colouring matter. Before this solidifies the greater portion is poured out again, leaving a thin layer in the mould, which is removed after it has solidified. The surface of the mould is treated with chromic acid or acetate of iron to prevent the compound adhering to it.

MEETINGS FOR THE WEEK.

MONDAY, May 8th.—Royal Geographical, 8.30.
Royal Institution, 2. (General Monthly Meeting).
TUESDAY, 9th.—Civil Engineers, 8.;
—— Royal Institution, 3. "Comparative Geology and former Physical Geographies of India, Australia, and South Africa," by Prof. P. M. Duncan, F.R.S.
—— Society of Arts, 11 a.m. Sewage Conference. 8. "The Commerce of the Gaboon; its History and Future Prospects," by R. B. N. Walker.
—— Photographic, 8.
—— Anthropological Institute, 8.
WEDNESDAY, 10th.—Society of Arts, 11 a.m. Sewage Conference. 8. "New Method of Propulsion for Street Cars," by E. H. Leveaux.
—— Geological, 8.
THURSDAY, 11th.—Royal, 8.30.
—— Royal Institution, 3. "On Voltaic Electricity," by Prof. Tyndall, D.C.L., LL.D., F.R.S.
—— Royal Society Club, 6.30.
—— Society of Arts, 11 a.m. Sewage Conference.
FRIDAY, 12th.—Royal Institution, 9. "Resistance of Ships," by W. Froude.
—— Society of Arts, 11 a.m. Sewage Conference. 8. (Chemical Section). "Salt Cake, with special reference to the Hargreaves-Robinson Process," by John Morrison.
—— Astronomical, 8.
—— Quekett Microscopical Club, 8.
—— Anthropological, 8.
SATURDAY, 13th.—Royal Institution, 3. "Chaucer," by F. J. Furnivall
—— Physical, 3.

Chemical Technology, or Chemistry in its Applications to the Arts and Manufactures. By THOMAS RICHARDSON and HENRY WATTS. Second Edition, illustrated with numerous Wood Engravings.

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GLASGOW CORPORATION GAS.

RESIDUAL PRODUCT WORKS TO LET, AND RESIDUAL PRODUCTS FOR SALE.

The Glasgow Corporation Gas Commissioners are prepared to receive OFFERS for a LEASE of their RESIDUAL PRODUCT WORKS, at Dawsholm, near Maryhill, and also for the PURCHASE of the TAR and AMMONIACAL LIQUOR produced at their GAS-Works there. The Lease to be for such Term of Years from 1st July next as may be agreed on. Offerers must offer a Fixed Rent of £1400 per Annum, and also a further Sum in respect of each Ton of Coal Carbonised at the Dawsholm Gas-Work. On application at the Gas Office (Manager's Department), 42, Virginia Street, intending Offerers will receive Orders for inspecting the Works. Conditions of Let may be seen in the hands of the Subscriber, from whom also Forms of Offer may be obtained, which will be received by him up till 1st June next.

The Commissioners do not undertake to accept the highest or any Offer

J. D. MARWICK,
Clerk to the Commissioners.

City Chambers,
Glasgow, April 27, 1876.

CANTERBURY GAS AND WATER COMPANY.

Offers are invited for the Purchase of the SULPHATE OF AMMONIA made at the Gas-Works during one year ending May 1, 1877. The estimated quantity is 40 tons. Tenders stating a price per ton, to be removed from the Works at the Contractor's expense, to be delivered at the Company's Offices before 10 a.m., on Friday, the 12th of May instant.

The Directors reserve the right to reject all or any of the Tenders.

JAMES BURCH, Secretary.

Castle Street, Canterbury,
May 1, 1876.

UPSET PRICE REDUCED TO £10,000 TO ENSURE COMPETITION.

FOR SALE.

CHEMICAL WORKS AT WHITECROOK, DALMUIR, NEAR GLASGOW.

To be Sold (under the Direction of the High Court of Justice) by Public Roup, within the Faculty Hall, Saint George's Place, Glasgow, on Wednesday, May 10, 1876, at 2 o'clock in the afternoon.

The Whitecrook Chemical Works of the British Seaweed Company (Limited), situated upon the Forth and Clyde Canal, with the ground connected therewith, and whole Engines, Machinery, Boilers, Retorts, Pans, Vitriol Chambers, Chimneys, and whole other Movable Plant, and Buildings on the ground, including Apparatus of the most approved construction for the manufacture on a large scale of Sulphuric Acid, Carbonate, Chlorate, Muriate, and Sulphate of Potash, Caustic Soda, Refined Brimstone, Iodine, Bromine, Iodide and Bromide of Potassium, &c. The Works have unusual facilities for water carriage, and are near to the Dalmuir Station of the North British Railway Company, by which there is direct communication to all parts of the United Kingdom. The ground connected with the Works extends to 8 acres and 10 and 7-10th poles (more or less) subject to a feu duty of £149 13s. Entry immediately.

For further particulars apply to H. J. C. F. Woodhouse, Public Accountant, 14, Warwick Court, Holborn, London; to J. N. Cuthbertson, Chemical Broker, 29, Bath Street, Glasgow, Official Liquidators of the British Seaweed Company (Limited); to Bannatynes, Kirkwood, and M'Cannel, Writers, 145, West George Street, Glasgow; to William A. Crump and Son, Solicitors, 10, Philpot Lane, London, E.C.; to Chauntrell, Pollock, and Mason, Solicitors, 63, Lincoln's Inn Fields, London, W.C.; or to Balfour and Paterson, Writers, 138, Hope Street, Glasgow, the latter of whom will exhibit the Titles and Articles of Roup.

Messrs. Mawson and Swan require the services of a Gentleman accustomed to the Chemical and Philosophical Apparatus Business.—11 and 13, Mosley Street, Newcastle-on Tyne.

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Wanted, appointment as above. Ten years manufacturing experience. England or abroad. Good linguist.—Address, R. J. A, 56, Bevington Road, Westbourne Park, W.

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Two Platinum Stills, that have been very little used, and were made in London, are for Sale.—For particulars address, Platinum, CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

On Sale, a superior Double-Roll Bone Mill, ready for delivery. Whole and Ground Coprolite; and Maker of all kinds of Machinery for Manure Works.—For particulars, J. I. Headly, Eagle Foundry and Coprolite Mills, Cambridge.

THE CHEMICAL NEWS.

Vol. XXXII. No. 859.

NEW RESEARCHES ON GALLIUM.

By M. LECOQ DE BOISBAUDRAN.

I have just reduced to the metallic state about 10 centigrms. of gallium, which I believe is very sensibly pure. As I have stated, the first specimen of gallium presented to the Academy owed its solidity to the presence of a small quantity of foreign metals. Pure gallium melts at about 29·5°, and is therefore liquefied when held in the fingers; it remains very readily in super-fusion, which explains how a globule remained in the liquid state at temperatures falling at times as low as zero. Gallium obtained by the electrolysis of an ammoniacal solution is identical with that prepared by means of a potassic solution. When once solidified the metal is hard and resistant, even at temperatures little below its melting-point. Nevertheless, it is sectile, and possesses a certain degree of malleability. Melted gallium adheres readily to glass, on which it forms a fine mirror, whiter than that produced by mercury. If heated to bright redness in presence of air gallium is only oxidised very superficially, and is not volatilised. In the cold it is not sensibly attacked by nitric acid, but with the aid of heat it dissolves with the evolution of red fumes. The specific gravity of the metal, determined approximately on a specimen weighing 64 milligrms., is 4·7 at 15° C., with respect to water at the same temperature. The mean sp. gr. of aluminium and indium is 4·8 at 0°. The specific gravity agrees, therefore, with theoretical prevision, but its extreme fusibility is a fact totally unexpected. For the other properties of gallium I must refer to my sealed packet, dated March 6, and to my former communications. With the permission of the Academy I will shortly describe certain new reactions of the compounds of gallium, and point out the method to be followed for its extraction from ores."

M. Wurtz laid before the Academy three specimens of gallium, one of them in a state of super-fusion, and demanded, in the name of M. Lecoq de Boisbaudran, that the sealed packet in question should be opened. This having been accordingly done by the Perpetual Secretary, it was found to contain the following paper:—

"The specimen of gallium which I had the honour of presenting to the Academy had been obtained by the electrolysis of an ammoniacal solution of sulphate of gallium. The metal thus prepared was solid, and even rather hard. Its solution in hydrochloric acid gave the rays of gallium with brilliance, and those of zinc much more feebly. The metal, therefore, was gallium containing, according to the indications of the spectrum, small quantities of zinc and insignificant traces of other metals.

"The solubility of oxide of gallium in ammonia not being great, I sought for some other solvent which might enable me to obtain concentrated solutions suitable for electrolysis. Caustic potassa dissolves a large quantity of oxide of gallium: this solution readily undergoes electrolysis, but the metal obtained by this process is liquid, and not solid like that obtained from an ammoniacal solution.

"The following observations have been made on about 1 milligrm. of liquid gallium:—

(1.) A very small globule, exposed to the open air for more than three weeks, lost neither its liquidity nor its metallic lustre.

(2.) The metal is deposited upon a negative electrode of platinum as a dead, whitish grey coating formed of numerous minute globules. It dissolves in the cold in dilute hydrochloric acid with brisk disengagement of hydrogen.

(3.) The hydrochloric solution of the metal yields a fine spectrum of gallium; along with the zinc rays more feebly. The latter are less marked than with the solid gallium from the ammoniacal solution.

(4.) The residue from the limited evaporation of the hydrochloric solution of the liquid metal is neither coloured by iodide of potassium, nor by ammonia, nor by hydrosulphate of ammonia. The dry residue from the evaporation was nevertheless sufficient to be distinctly visible. Mercury, therefore, is not present.

(5. Liquid gallium, deposited by electrolysis upon a small piece of platinum, was heated to redness, or almost to redness. It adhered and doubtless became alloyed with the platinum, and resisted the action of hydrochloric acid, but it was attacked by weak *aqua regia* along with a little of the platinum; the solution showed the rays of gallium. A slight whitish pellicle, insoluble in *aqua regia*, was detached from the platinum; this was, perhaps, oxide of gallium rendered insoluble by ignition.

"At the time of those experiments I still had a portion of the gallium which I had presented to the Academy, and which had been returned to me. I made use of it to satisfy myself anew of the hardness of this gallium, and of the nature of its spectrum, which I found as before was composed of brilliant gallium rays, feeble zinc rays, and insignificant traces of other metals.

"We cannot ascribe the liquidity of the gallium obtained by the electrolysis of a potassic solution to the presence of a small quantity of potassium reduced by the voltaic current, since the alkaline metal would have been quickly oxidised, both during the washings and by contact with moist air. I think, therefore, that pure gallium is really liquid, and if I obtained it at first in the solid state it was probably by reason of its being alloyed with small quantities of other metals, especially zinc. Solid gallium is, in fact, less pure than liquid gallium. The solidity of gallium seems to be caused by relatively inconsiderable quantities of foreign metals.

"We may still suppose that by the electrolysis of an ammoniacal solution there is deposited, not pure gallium, but a compound of the metal with the elements of ammonia—a hydride, amidide, or nitride.

I eagerly await the time—I hope not far distant—when, having at my disposal several centigrms. of purified gallium, I shall be able to determine its physical properties, which promise to be interesting."—*Comptes Rendus.*

REPORT

ON THE

DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

Progress in the Artificial Production of Cold and Ice.

By Dr. H. Meidinger.

(Continued from p. 188.)

In 1869 the design and description of an ice machine constructed by F. Windhausen, of Brunswick,† were made public. It has only one cylinder, with a piston of the diameter of the height of the stroke. On one side of the piston there occurs compression and on the other expansion. The compressed air is forced through a cooler with a large surface, which serves at the same time as a

* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzehends."

† Windhausen, *Mech. Mag.*, 1869, 387. *Dingl. Pol. Journ.*, cxcv., 115. Wagner, *Jahresberichte*, 1870, 542.

reservoir for the compressed air. Whilst on one side of the piston the air is compressed it expands on the other. On the return of the piston the cold air is forced into the ice-chest, from which, when deprived of its cold, it is immediately drawn on the other side of the piston. That side of the long cylinder in which condensation takes place is surrounded with water as a cooling agent, whilst the other end is packed with a bad conductor of heat. The broad piston renders it impossible for an equalisation of temperature to take place within the cylinder. For this purpose there requires an especial external arrangement for the admission and for the cutting off of the air which enters the expansion end. If the object is not to make ice but to cool spaces, the expanded cold air is forced directly into these, whilst the fresh external air is drawn into the compression end of the piston. As regards the performance of the machine nothing has transpired.

In the summer of 1871 the author saw at Berlin a powerful ice machine destined for New Orleans, constructed and experimentally set up by Windhausen. The construction was different from that above described, the compression and expansion cylinders being distinct, according to the scheme which we considered as most correct in principle, and took for the foundation of our preliminary investigation. It yielded air at −40° C., which was filled with abundant snow-flakes. As the compression cylinder constantly drew in fresh air, hygroscopic water was deposited in the cooler, where on account of the contracted space it could no longer remain in the state of vapour. From there the air, saturated with water, passed into the expansion-cylinder, and in consequence of the cold produced by the expansion the greater part of the existing vapour was necessarily deposited as snow. This circumstance very much interfered with the working of the machine, as the friction of the piston was considerably increased by the snow, which also choked up the escape-pipes. The latent heat set at liberty acted also in opposition to the fall of the temperature even though the sum total of the negative heat units was not lessened. The piston was appropriately lubricated with glycerin. The author could ascertain nothing as to the experimental measurements made to determine the actual effect of this machine.

Since the beginning of 1873 Nehrlich and Co., of Frankfort-on-the-Main, make the Windhausen machine with two cylinders of one size only, with especial regard to the demand in breweries. It requires a 40-horse power engine, and is guaranteed to yield hourly 2500 cubic metres of air at temperatures of from −30° to −50°. If we assume that these temperatures refer to initial temperatures of from 10° to 30° the total reduction of temperature amounts to 60°, whence the amount of the negative heat units may be calculated as 50,000, corresponding at most to 400 kilos. of ice. If the production of ice were the object in view the same quantity of air might be made to circulate. A steam-engine of 40-horse power consumes hourly 80 kilos. of coal; consequently 1 kilo. of coal would give 5 kilos. of ice—a very favourable result. Such a machine, including the engine, cost in 1873 66,000 marks (£3300).

L. Mignot,* of Paris, in 1870, constructed also an air ice machine with distinct compression and expansion cylinders. It is distinguished from that of Windhausen by the arrangement that a small pump injects water into the compression-cylinder, and that the air in the condenser sweeps over open water. This arrangement is, without doubt, advantageous. The labour of compression is much reduced when the temperature of the air is kept low. The water cannot have an injurious effect in the air since the cooled and compressed air is in any case saturated with moisture. It may therefore be expected that the compression of the air will be effected at a less cost, and its complete refrigeration will require a smaller condenser. Particulars concerning this machine have not transpired. The more recent Windhausen machines are also provided with an injection apparatus.

(To be continued)

* L. Mignot, *Mech. Mag.*, Dec., 1870, 404. *Dingl. Pol. Journ.*, cxcix., 362. Wagner. *Jahresbericht*, 1871, 696.

THE DETECTION OF ADULTERATIONS IN COFFEE.*

By Prof. G. C. WITTSTEIN.

BEFORE coffee is brought to us as a beverage it is not unfrequently subjected to different adulterations, one of which is even carried so far that of the original bean nothing but the mere name remains. H. Ludwig, for instance, relates that in commerce coffee-beans are found which are made of dough moulded after the true bean in the most perfect and deceptive manner. Such beans, however, unlike the genuine, always possess sharp edges, and may be very easily ground to a grayish yellow powder. On boiling with water they are converted into a pasty mass, which on addition of iodine assumes a deep blue colour. The detection of this imitation is therefore never attended with difficulty, and it may only escape notice if the proportions in which the artificial product is mingled with the natural bean are comparatively small.

The attempts, however, of imparting to the poorer classes of coffee the colour and general appearance of the more excellent varieties, are far more frequent. The methods of arriving at this end, whether through colouring matters or otherwise, are quite various. (See *Polyt. Journ.*, 1874, No. 213, 172.) I am informed, from sources of unquestionable authority, that one of these methods consists in placing the coffee together with a sufficient quantity of shot or lead granules in an empty barrel, rolling the latter about for some time until enough lead has been rubbed on the beans to give them the glossy appearance usually considered characteristic of the better qualities of coffee. This adulteration is not easily detected by the naked eye; usually a good lens will suffice. When absolute certainty, however, is desired, it will be found convenient to adopt the following process:—Digest the suspected beans with dilute nitric acid (1·10 sp. gr.); decant the liquid after one hour, dilute with three times its volume of water, and then precipitate the lead with sulphuretted hydrogen as usual.

Another substance for colouring coffee is a greenish powder, one hundred parts of which, according to the analysis of Lohr, are composed of 15 parts Prussian blue, 35 parts chromate of lead, 35 parts of a mixture of clay and gypsum, 15 parts water. Use is, therefore, here made of a mixture similar to that which the Chinese have for some time employed for the colouration of green tea, except that in the latter mixture turmeric is substituted as the yellow constituent in place of the harmful plumbic chromate. The different ingredients of the coloured mixture—Prussian blue often replaced by indigo (Warington), turmeric, and gypsum—may be quite distinctly seen adhering to the tea-leaves under the lower powers of the microscope, or even by a good lens, as I have often had occasion to convince myself.

The microscope alone, therefore, is frequently sufficient to discover whether a similar mixture adheres to the coffee beans or not. For more accurate examination, however, it is better to put a considerable quantity of the beans in a suitable vessel, and to pour distilled water upon them. After two hours or so the beans are removed, and the turbid liquid allowed to settle. In presence of gypsum the supernatant clear liquid will become densely turbid on addition of baric chloride and ammonic oxalate. Prussian blue may be detected in the sediment by giving rise to a brown colouration on addition of KHO. If this change of colour should not occur, the mixture will not

* *Dingler's Polyt. Journ*, No. 215, 84 (translated for *American Chemist* by Carl Barus).

contain Prussian blue, but probably indigo. The colour of the latter may be destroyed by nitric acid. The potassic hydrate will likewise decompose the plumbic chromate to a greater or less extent, causing it to dissolve partially or wholly in the alkali. Turmeric, if present, would merely turn dark brown. If, upon slightly moistening the sediment with sulphide of ammonium, a black colour is produced, no further doubt need be entertained as to the presence of chrome-yellow in the mixture.

By the process of roasting, coffee is put into a condition which renders adulteration almost impossible so long as the beans remain unground. Ground coffee, however, is one of the easiest substances to adulterate. Who does not know of the numerous essences, &c., which have come into commerce from time to time, and even at present are constantly recommended under various names, true and false? Be their name, however, what it may, the general appearance and properties of the substances are always the same; they occur as a more or less dark brown, coarsely pulverulent mass, of a peculiar empyreumatic odour, and of a similar bitter aromatic taste. They are most commonly perhaps called "chicory coffee," from the fact that the root of the *Chicorium intybus* is the principal ingredient in their manufacture. When a sufficient quantity of the latter is not at hand, red beets, carrots, and other roots resembling the turnip in properties, are substituted for it, and in Southern Europe figs are roasted, by which process a peculiar product known as fig-coffee is obtained.

As all these preparations undergo the same treatment as pure coffee, namely, of roasting to a deep brown colour, it is not surprising that in many particulars they should resemble the genuine article very closely. They cannot, however, be used as a true substitute for the latter, as all are without the most important constituent of pure coffee, namely, caffeine. Compared amongst themselves they resemble each other so closely that it would be next to impossible to discover from what substances any one may have been produced. The process of roasting has not only totally destroyed or so changed the former properties of the material that any attempt to recognise them would be hopeless, but has furthermore introduced a great number of new products the nature of which is but little known, all of which, however, are characterised by an empyreumatic oil and extractive matter. Even if the raw material possessed no bitter properties (as is the case with turnips and figs) the roasted product will always exhibit it in very marked degree; and it is known that to the originally bitter qualities of coffee and chicory, a new product, similar in properties, to which Reichenbach gave the name "assamar," is added.

It is therefore evident that bitterness of taste is no criterion for distinguishing these artificial preparations from coffee. As there is, however, an unquestionable difference between the two, it must be sought in the different behaviour of the empyreumatic oils. The nature of these oils, however, at the present day is so little understood that we are only able to separate them by difference of taste and smell, and, indeed, this means of distinction would be fully sufficient if it were only necessary to distinguish between ground chicory and ground coffee. When, however, as is usually the case, the material to be examined is a mixture of the two in which the adulteration occurs in a comparatively small quantity, we are altogether at a loss. It being obvious, therefore, that in general taste and smell lend us but little aid, it will be necessary to investigate special modes for the examination of the mixtures in question.

The following is a very convenient manner of proceeding:—The suspected coffee is poured out on water. If pure, the particles will float, and remain in a state of suspension for hours, whereas chicory will sink immediately. This process, however, is not always altogether reliable in its results; for Denault relates a case where a specimen of coffee, roasted and ground by himself, sank within a quarter of an hour, while specimens of other pure coffees which he examined floated as long as ten hours. Chevalier mentions a similar experience. To me, however, this test has always given satisfactory results.

J. Horsley, some time ago, proposed the following process for the detection of chicory in coffee:—If to a much diluted decoction of chicory, a solution of bichromate of potash be added, no sensible reaction will take place. If, however, we subject to this same reagent a decoction of pure coffee, its colour will immediately darken, and become brown similar to porter. This is, therefore, an easy method of distinguishing between the two, provided they are separate. In mixtures the determination of the impurity becomes much more difficult. In this case a dilute decoction is made of a weighed quantity of the suspected mixture. It is then to be heated to boiling and treated with the solution of bichromate of potash. A few decigrammes of copper sulphate are next added, and the solution is again to be boiled, whereupon a dark brown flocculent precipitate will be formed. The depth of its colour depends on the quantity of coffee in the mixture; and we have thus, by comparing this precipitate with a similar one of the same quantity of pure coffee, an approximate method of examining our mixture quantitatively.*

From its importance I had this method examined by Mr. Rotmanner; it did not, however, give us any satisfactory results. Dilute infusions of chicory and coffee indeed gave, with the bichromate, the reactions which Mr. Horsley has indicated, namely, no sensible reaction with chicory, but a deep brown colouration with the coffee infusion. When to an infusion of the mixture bichromate of potash and copper sulphate were added, the precipitate above mentioned was also formed. But the precipitate from pure coffee was exactly like it. Hence, though by this process coffee may be detected in chicory, it is absolutely worthless for the detection of chicory in coffee.

These unsatisfactory results influenced me to investigate the subject somewhat further. Decoctions of each with 8 parts water were made, which afterwards were further diluted to 12 parts.

If to 30 drops of the coffee decoction in a test-tube 2 drops of conc. hydrochloric acid be added, and then, after a few seconds boiling, the liquid be treated with 15 drops of a solution of 1 part red prussiate of potash and 8 parts of water, and again boiled as before, the liquid will first turn green, finally blackish green. Upon now adding to the mixture 6 drops KHO, the liquid, after 1 to 2 minutes further ebullition, will become brown, and shortly after, with the deposition of a dirty yellow precipitate, clear, pale yellow. If the chicory decoction is subjected to the same treatment, the last liquid will be brown and turbid, and only after long standing will a precipitate be deposited while the supernatant fluid retains its brown colour. By testing in the same manner a mixture of 6 drops chicory and 24 of coffee, the brown turbidness will also be obtained. It is thus easily possible to discover adulterations of chicory in coffee.

The quantity of coffee actually dissolved in a decoction is perhaps always over-rated. A good, by no means weak, infusion, left upon evaporation a residue of 1 per cent, and a very strong infusion scarcely 2 per cent. This residue has the appearance of a dark brown shining varnish, which is scarcely hygroscopic,—at least remains dry after two days' exposure. If, however, the coffee contains one of the artificial preparations above referred to, the residue will become sticky to the fingers within two hours, and will after twenty-four hours be decidedly moist. This simple process may likewise be used as a test upon suspected coffee.

Even the impurity in coffee, chicory, is subject to various adulterations,—among others, with bog-turf. On

* This reaction is not due, as might be supposed, to the colouring matter of the coffee, but to the tannic acid present therein, for an infusion of green coffee behaves in the same manner.

this matter I have no personal experience. According to Prof. Th. Schwartz, of Ghent, however, this fraud is practised to a considerable extent, especially in Flanders.

RESEARCHES ON THE SOLID CARBON COMPOUNDS IN METEORITES.*

By J. LAWRENCE SMITH, Louisville, Ky.

In the study of meteorites it is well known that, of all the simple and compound substances met with in these bodies, the carbon has received the least study and investigation. This has arisen principally from the limited amount of material at the command of the chemist,—a fact to be regretted, since if any one element more than another demands attention and excites wonder at the part it plays, either as an element or in its endless combinations with other substances, that element is carbon.

In its elementary condition we see it in crystals of exceeding hardness and brilliancy in the diamond, and also in irregular, nearly opaque masses that are not to be confounded with the diamond. Again, we have carbon in a soft, black, unctuous state, either in lustrous flaky crystals or in fine-grained masses. It also occurs in the harsh and gritty form of coke, sometimes changed to an unctuous body approaching graphite in aspect, yet different physically as well as in some of its chemical relations. Deposits of anthracite furnish carbon in yet another form. Besides these, the results of decomposition of what are known as organic compounds give quite a list of different forms of carbon, made either by the incomplete combustion of hydrocarbons, or by passing through red-hot tubes the vapours of hydrocarbons, chloride of carbon, sulphide of carbon, &c., or by the decompositions of such substances as carbonic acid, carbides of boron, of iron, of manganese, &c.

These various forms of carbon have certain chemical differences, more or less marked, which differences have attracted the attention of chemists; although no one has studied them with much care or success except M. Berthelot, the investigations being difficult on account of the want of proper methods. M. Berthelot obtained his results by taking advantage of the singularly slow oxidising action of a mixture of nitric acid and chlorate of potash on carbon, first pointed out by Sir B. C. Brodie, in 1860,† in experiments on graphite, by which he produced for the first time what is known as graphitic oxide. He operated by this means on very many specimens of carbon, from the diamond to lampblack, embracing a large variety of artificially prepared carbons, and discovered certainly six or eight more or less distinct chemical characteristics of these different carbons.‡ The physical differences of some of them are well known; among them none is more remarkable than that of their specific heats. Other bodies known as elements—as silicon, boron, oxygen, &c.—take upon themselves different conditions called allotropic conditions,§—a term applied to the isomeric conditions of simple bodies,—but carbon differs from these, not only in exhibiting a most wonderful variety of allotropic conditions, but also in the phenomena coming under the head of isomerism, polymerism, and metamerism; so much so that we are disposed to take this body away from the rank of a mere element, and call it a protean body, that gives rise to substances of endless form and variety by combining with a very limited number of elements.

Additional interest attaches to carbon from the fact of its being regarded as belonging pre-eminently to the organic kingdom. In fact, some of the best observers and investigators assume that there is no such thing as mineral carbon among the rocks of our globe, and that wherever found—whether as diamond, graphite, or coal—it is a product derived from organic matter, in which it had first performed its part in the economy of nature.

A still more exciting interest has been felt in carbon since the new department of celestial chemistry has received the attention of scientists. And here we are not left for our knowledge of celestial carbon to the attenuated form of it which can be detected only by astronomical instruments; for masses of matter from other spheres reach our globe from time to time, bringing with them specimens of solid carbon for our investigation, and, at the same time, perplexing our minds with questions as to its mineral or organic origin, and as to the existence or not of life on other planets, and in other systems of planets.

Like the footprints of former life on the rock strata of our globe, these indications in what we call meteorites, however slight they may be, are not to be disregarded. While I do not wish to arrogate to myself any undue merit in the study of this subject, I must say that I believe that my methods published in 1855 set forth more prominently than it had been done before, the proper method of research for arriving at correct conclusions. It is clear that to attain positive results, the astronomer, physicist, mineralogist, and chemist must not run counter to one another in the use of the facts severally studied by them, and in all that I have done in this direction it has been my effort to keep this in view.

In the present memoir it is my object to develop new facts, and consider some points in connection with the carbon of meteorites.

The Carbonaceous Meteorites.

Certain well-known meteorites, from among those whose fall has been observed, have been called, from their aspect and from their containing a small amount of carbon, *carbonaceous* meteorites, although the small amount of carbon contained in them is not sufficient to account for their colour. Perhaps the term *melanotic* meteorite would be a more appropriate one to distinguish them from the stony and iron meteorites. There are but four of them yet known, viz., that which fell at Alais in 1806, that at Kold-Bokeveldt in 1838, that at Kaba in 1857, and that at Orgueil in 1864. They contain, respectively, about 3·0, 2·0, 0·6, and 6 per cent of carbonaceous matter.

I would here remark that the Alais, Kold-Bokeveldt, and Orgueil are more closely allied to each other than to the Kaba meteorite. The predominating mineral constituents are about as follows:—

	Alais, by Berz.	K.-Bok, by Harris.	Kaba, by Wohler.	Orgueil, by Pisani.
Silica	31·22	30·80	34·24	26·08
Magnesia	22·21	22·20	22·39	17·00
Iron protoxide ..	29·03	29·94	26·20	29·60

If we now contrast these mineral constituents with those predominating in well-known meteoric stones, a most striking fact presents itself, one not commonly realised by those engaged in the study of these bodies. It is seen on comparing the above with the following tables:—

	Chassigny.	Chateau Renard.	Harrison City.	Concord.	Danville.	Searsmont.
Silica	35·30	38·13	47·30	47·30	50·08	40·61
Magnesia ..	31·76	17·67	24·53	24·53	20·14	36·34
Iron protoxide	26·70	29·44	28·03	28·03	19·85	19·21

From these tabular statements it will be seen that, deducting the small amount of carbon contained in the black meteorites, the mass of mineral matter constituting them is about the same, and corresponds thus with the so-called common type of meteoric stones; and hence the mineral matter to which these constituents belong must be the

* Communicated by the Author.

† *Annalen der Chemie und Pharm.*, April, p. 6.

‡ The full detail of his researches is to be found in the *Annales de Chimie et de Physique*, 4th Series, xix., 392, 1870, and xxx., 419, 1873.

§ Notwithstanding the recent experiments of M. Weber, showing that, under certain conditions, carbon, silicon, and boron are not exceptions to the law of Dulong and Petit, they still occupy a singular position in regard to specific heat.

same in the two classes of meteorites, viz., olivines and pyroxenes, differing only in the more or less compact form of these minerals.

In the writings of some of the most astute observers of these bodies, we find little stress laid on these facts. Thus M. Meunier, in a paper on the origin of meteorites, published in the *Cosmos* of December, 1869, expresses his amazement that I should speak of the circumscribed uniformity of the composition of meteorites as evidence of a circumscribed cosmical origin of these bodies, both with reference to the sphere or spheres whence they come, as well as their rock structure. He takes so opposite a view as to say—"So far from the meteorites showing such a resemblance, we can establish between meteoric iron, olivine meteorites, aluminous meteorites, and carbonaceous meteorites, differences as great as between the most different terrestrial rocks." An assertion which would include all the ranges of rocks and sedimentary deposits from the basalt and granite to the cretaceous and tertiary deposits.

Let anyone look at the above table, and say whether or not he sees so vast a difference in the mineral constituents of the different meteorites there enumerated; and yet they represent the two extremes of these bodies so far as their external properties are concerned. It is well known that three or four minerals represent the great mass of the constituents of every meteorite in various proportions, viz., nickeliferous iron, olivine, pyroxene, and anorthite, especially the first three; and the purely iron meteorites must be recognised as magnified masses of the metallic particles to be found in every stony meteorite, not excepting even the carbonaceous meteorites.*

My object, however, in this paper is not to discuss at length the general internal resemblances of these bodies, as I may have occasion to do it more fully at another time. I wish simply to note, that black and pulverulent as are the carbonaceous meteorites, they are not removed by their mineral constituents from the so-called common meteorites. I now pass on to show that even in their carbonaceous constituent they are strongly linked even to the iron meteorites.

Graphite Carbon in the Iron Meteorites.—Ever since the internal structure of this class of meteorites has been examined by sections through the centre of these compact metallic masses, nodular concretions have been noted in their interior, the most common of which consist of *troilite*, a protosulphide of iron, and filling ovoidal cavities. Sometimes these troilite concretions have a thin coating of a lighter-coloured mineral known as *Schreibersite*, and this last is also found alone in concretionary masses which are usually angular or lamellar.

Less frequent concretions than either of the above, and even more remarkable, consist of carbon of the character of *graphite*: these, like the troilite, usually fill irregular ovoidal cavities, and are more or less contaminated with the latter mineral.

The most important of the meteoric irons containing these nodules, that have come under my immediate observation, are the Toluca, the Cranbourne, the De-Kalb, and the Sevier: the last two have received my special study, the latter furnishing much the larger part of the material in my hands.

Character of the Graphite Nodules.—These concretions differ more or less in appearance, while their general character is the same. In this communication I call special attention to a large nodule taken from the very centre of the Sevier iron, the largest that has come under my observation, and perhaps the largest known. It was detached from the iron entire and perfect in every respect. Its greatest length is 60 m.m. Its dimensions in the other direction vary from 20 to 35 m.m. The weight before it was cut was 92 grms. Its form is that of an irregular dumb-bell, flattened on one side, and slightly nodular on the surface. Its colour is plumbago-black, except at small places on the surface, where there is a little bronze-coloured troilite. Its texture is remarkably close and compact, and it is cut readily by the saw, except when the tool encounters particles of enclosed troilite. Its structure and powder is not unlike that of the close-textured graphite of Borrowdale, in Cumberland, England, and quite unlike the scaly graphite such as that from Ceylon, or that found in certain cast-irons.

Examined from the circumference to the centre, this nodule presents the following appearances:—About one-fifth of the circumference of the section is made up of troilite with a thickness of 1 m.m. The remainder of the section has all the aspect of graphite, except in a few spots. In the nodule there is a small mass of troilite not unlike in form the entire nodule: it is 10 m.m. long by about 5 m.m. wide; it is not continuous from its circumference to its centre, but the centre portion is cut off completely from the exterior portion by a thin belt of graphite, $\frac{1}{2}$ to $\frac{3}{4}$ m.m. in thickness. Again, on other parts of the surface small particles of troilite are to be seen.

The specific gravity of this graphite is 2·26 m.m., as determined on a piece in which no troilite was visible to the eye, and after it was immersed in water and placed under the receiver of an air-pump to abstract the air from its pores.

(To be continued.)

* At present the Orgueil and Rh...n meteorites are the only two in which no positive evidence of the presence of nickeliferous iron has been traced: in the Orgueil, however, we find nearly 3 per cent of oxides, nickel, and cobalt, and the Rhoda has not been very critically examined.

EXHIBITION OF SCIENTIFIC APPARATUS AT SOUTH KENSINGTON.

AVAILING ourselves of the admission card courteously placed at our disposal, we paid a long and admiring visit to this interesting collection. The tedious task of unpacking, arranging, and labelling the specimens was not by any means complete, especially in the departments which chiefly attracted our attention. But for this we can no more censure the Committee and their officials than for the somewhat perplexing character of the building, which renders it difficult for the visitor to know when he has really seen all. On the contrary, having some little acquaintance with the getting up of exhibitions, we should rather congratulate all concerned on having accomplished so much. We cannot, however, pronounce the classification of the objects unexceptionable. Thus, when a chemist visits the chemical department, one of his earliest inquiries will be for the apparatus which first gave chemistry the character of an exact science—the balance. But except certain historical instruments once used by Cavendish, Young, Davy, Black, and Dalton, he will find that he must look elsewhere. In fact, the masterpieces of such makers as Oertling, Sartorius, &c., are placed in the mathematical department among measuring-wedges, water-meters, planimeters, and the like! Yet graduated glasses, burettes, &c., are found not among measuring instruments, but in their ordinary place among the requisites of the laboratory. Surely the true principle—which, indeed, has been generally followed in this exhibition—would have been to place under every science all the instruments required in its study.

One of the most interesting features of this exhibition consists of instruments which once belonged to illustrious discoverers. Men of science are generally described as hard, dry, and unimaginative, but we presume few will be able to look at the balances above mentioned, at the battery with which Davy decomposed the alkalies, at the pneumatic trough of Black, the telescope of Galileo, or the microscope of Leeuwenhock, without reverential emotion. It strikes us, however, that this collection of the rude appliances with which our predecessors achieved such mighty results could easily have been extended by the kindness of our Continental friends. Has France no sacred memorials of Lavoisier, of Gay-Lussac, or of Ber-

thollet, which might for a short season have been entrusted to our care? Could Sweden have sent us no relic of Berzelius or of Scheele? We most sincerely regret that the example set in this respect by Italy, Germany, and Switzerland has not been more universally followed.

Taken as a whole, the formation of this "loan collection" may be regarded as a hopeful symptom as a proof that the importance of science as a main factor in national power and prosperity is approaching nearer to recognition.

We can at present scarcely enter upon a detailed notice of the objects and specimens which most attracted our attention. We were much pleased with the fine series of preparations of vanadium contributed by Prof. Roscoe, F.R.S., of Owens College. These compounds will command general interest on account of the recent application of vanadium in the development of aniline-black. The close similarity between the solutions of vanadous sulphate and copper sulphate, and again between the chromate and vanadate of potassium is very remarkable. The specimens of coal-tar derivatives, contributed by Mr. W. H. Perkin, F.R.S., are also worth a careful examination. Turning from laboratory preparations to commercial chemicals we find samples illustrative of Mond's process for recovery of the sulphur from tank-waste as carried on at the works of J. Hutchinson and Co., of Widnes; a series of specimens explanatory of Spence's process for the manufacture of alum; specimens of oxalic acid made by Roberts, Dale, and Co., by the action of caustic alkali upon woody fibre; carbolic, cresylic, and picric acids, aurin, &c., exhibited by F. C. Calvert and Co., and a series of coal-tar colours as manufactured by Messrs. Brooke, Simpson, and Spiller, including artificial alizarin and the still more splendid anthrapurpurin. In spite of these and some other very interesting exhibits it is plain that the collection does not give, and indeed does not profess to give, a full view of the chemical manufacturers of the day. The apparatus —the main feature—we shall endeavour to describe on a future occasion.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, May 4th, 1876.

Dr. GILBERT, F.R.S., Vice-President, in the Chair.

AFTER the names of the visitors had been announced, and the minutes of the previous meeting read and confirmed, the following names were read for the first time:—Messrs. R. H. Harland, J. Edmunds, M.D., H. Holcroft, J. G. A. Stitt, T. Tyrer, C. A. Buckmaster, B.A., S. Hall, S. Gilchrist, Percy C. Gilchrist, and W. Hibbert. Messrs. H. C. Jones, Adrian J. Brown, and Sir David Salomans were then ballotted for and duly elected after their names had been read the third time.

The first paper, "*On Glycero-phosphoric Acid and its Salts as obtained from the Phosphorised Constituents of the Brain*," by Dr. J. L. W. THUDICHUM and Mr. C. T. KINGZETT, was read by the latter. On boiling kephalin, $C_{42}H_{79}NPO_{13}$, for several hours with baryta water, a solution was obtained, containing one or two nitrogenous bases and the barium compound of glycero-phosphoric acid, $C_3H_5(OH_2)BaPO_4,H_2O$. The authors then described the lead salt, the normal and acid calcium salts and the barium salt of this acid, also an alcoholo-hydrated barium glycero-phosphate containing 20·9 per cent of alcohol and 11·14 of water.

In reply to a question by Dr. Tilden, Mr. KINGZETT explained that no compound had been found in the brain in which the phosphorus was in a lower state of oxidation than phosphoric acid.

The next paper was "*On some Reactions of Biliverdin*," by Dr. THUDICHUM. The author, after stating that the cause of the yellow colour of the skin of persons suffering from "yellow jaundice" was bilirubin, whilst the dark colour of the so-called "black jaundice" was due to the presence of biliverdin, proceeded to describe some derivatives of the latter substance. *Monobrominated biliverdin*, $C_8H_8BrNO_2$, was prepared by passing bromine vapour mixed with dry air over finely powdered biliverdin until it ceased to be absorbed, and the product was then heated to 100° C. in a current of dry air. It is a black powder, insoluble in ether, and very little soluble in alcohol. It is soluble in sulphuric acid, but is precipitated on dilution with water. It is also soluble in caustic soda, being precipitated again in brown flocks by acetic acid. *Hydro-biliverdin* is formed on treating a solution of biliverdin in dilute caustic soda with sodium amalgam. Its dilute alcoholic solution gives a spectrum showing an absorption-band overlying the line F equilaterally, and totally different from the broad band between E and F shown by solutions of hydro-bilirubin.

In reply to a question put by Mr. C. E. Groves, as to how it was ascertained that the colour of the skin of a jaundiced person was due to bilirubin or biliverdin, the AUTHOR said that in the case of yellow jaundice, the bilirubin could be extracted from a portion of the skin by treating it with chloroform, whilst the biliverdin, which produced the colour in black jaundice, could be extracted with alcohol, and the solutions then examined by the spectroscope. He also stated in reply to a question of the Chairman that in the forms of yellow jaundice which were the acute cases some obstruction of the biliary duct caused the bile to be poured out into the blood, whence it passed into the system. In chronic cases, the bilirubin after a time became oxidised to biliverdin, giving rise to black jaundice.

A paper "*On the Relation between Chemical Constitution and Colouring Power in Aromatic Substances*" was then read by Dr. O. WITT. In this paper the author endeavoured to show that the immense variety of colouring matters was due to a clearly definable law, and also the reason why some bodies are coloured whilst others, which are sometimes isomeric with them, are not colours. In the case of nitro-phenol, $C_6H_4(NO_2).OH$, and of nitraniline, $C_6H_4(NO_2).NH_2$, the colouring properties are partly due to the nitro group, but not entirely, as neither mono- nor dinitro-benzene possessed colouring powers. Only the combination of the nitro with the amido or oxy groups produced the colour, and both these were able to form salts, which the nitro group could not do. In these instances the NO_2 was the colouring group, but it could only exert its influence when another acidifying or basifying group was present. He purposed to call the colouring group the *chromophor*, and the substance containing the chromophor, but not a salt-forming group, the *chromogen*. Thus, in the examples given, the NO_2 was the chromophor and nitro-benzene the chromogen of nitraniline and nitro-phenol. In the important colours which were derived from azo-benzene, such as "Bismarck brown," he considered the group $N{=}N$ as the chromophor; azo-benzene and related bodies, such as tetazo-diphenyl, being the chromogens. It was not necessary that the chromophor should be a group containing nitrogen; the CO groups in the chromogen anthraquinon were the chromophors. On communicating salt-forming properties to anthraquinon by means of hydroxyl or amido groups we obtained colouring matters, whilst if we deprived these groups of their salt-forming properties, by acetylation for instance, the substances so treated lost their colouring properties.

Mr. W. H. PERKIN said he felt much interest in Dr. Witt's remarks, but thought that colour should be considered as such, and not solely in relation to dyeing. The property of dyeing was merely an accidental one, due to some affinity between the fibre and the substance, and independent of its colour. It seemed to him it would be difficult to reconcile the properties of indigo with the theory put forward by Dr. Witt.

Mr. C. E. GROVES mentioned some facts which were in

accordance with Dr. Witt's views. For instance, when the hydrogen of the OH group in picric acid was displaced by ethyl or methyl, it gave an almost colourless substance. Again, resorcin, which was colourless, gave a brilliant trinitro-derivative; but if the hydrogen in the OH groups in this were replaced by ethyl, it was converted into a nearly colourless ethyl compound, $C_6H(NO_2)_3(OC_2H_5)_2$. Orcin, the methyl derivative of resorcin, behaved in a similar manner.

Dr. ARMSTRONG thought this theory might lead to very interesting results, if it were not confined to dyes merely. Körner had noticed that whilst the ortho derivatives were strongly coloured, the corresponding para and meta compounds had a feeble colour. This was well seen in the isomeric mono- and dinitro-phenols. Thymoquinon was of a pale yellow colour, but the oxy-thymoquinon was of a richer colour, and yielded a deep violet with alkalies.

Mr. NEISON thought that a careful consideration of the circumstances influencing the colour of bodies was of very great importance, as it might enable us to determine what was actually the physical constitution of such substances.

Dr. OTTO WITT, in reply to Mr. Perkin's remarks on indigo, said it was a very peculiar case. The influence of the chromophor and the chromogen was divided: the salt-forming group existed only in the white indigo, and when the fabric was dyed and exposed to the air the chromophor was liberated, and produced the colour.

The CHAIRMAN having thanked the author for his interesting paper,

The SECRETARY read a communication, "*On Certain Bismuth Compounds (Part II.)*," by Mr. M. M. P. MUIR. In this the author mentioned that in preparing bismuth tribromide by the process given in his former paper, a certain quantity of the oxybromide, $Bi_8Br_6O_{15}$, was also formed. It is a greyish yellow crystalline substance, insoluble in water, but readily soluble in dilute acids. The remainder of the paper is occupied with the description of four chromates of bismuth, for which the author proposes the following names and formulæ:—*Bismuthyl chromate*, Br_2O_3,CrO_3; *bismuthyl dichromate*, $Br_2O_3,2CrO_3$; *monohydrated bismuthyl dichromate*, $Br_2O_3,2CrO_3,H_2O$; and *monohydrated bismuthyl tetrachromate*, $Br_2O_3,4CrO_3,H_2O$. They are all insoluble in water, and the last two are crystalline.

The next two papers were by Mr. WATSON SMITH, the first being entitled "*A New Method for the Preparation of the Hydrocarbons, Diphenyl and Isodinaphthyl, and on the Action at a High Temperature of Metallic Chlorides on Certain Hydrocarbons.*" On passing the mixed vapours of benzene and antimony trichloride through a red-hot tube diphenyl is produced, and in larger quantity than with benzene alone. On employing stannic tetrachloride, diphenyl is formed in large quantity, being found in the receiver in solid cakes. This is undoubtedly the best method for procuring diphenyl in quantity. Toluen treated in a similar way gives but unsatisfactory results. When naphthalen and antimony trichloride are passed through a red-hot tube isodinaphthyl is obtained with comparative readiness. The frequent stoppage of the tube by reduced carbon, when tin tetrachloride is employed, renders the method with antimony trichloride far preferable. The author finds that the corrected melting-point for isodinaphthyl is really 187° C., and not 204° C. as formerly stated.

The second was "*A Note on the Occurrence of Benzene in Rosin Light Oils.*" In refining rosin by distilling it in a current of superheated steam a quantity of light oils is simultaneously obtained. On examination it was found that the oils contained a large proportion of benzene, which on treatment with nitric acid yielded nitro-benzene, although somewhat impure. Recently an alteration had been made in the manner of distillation, a much higher temperature being used, and it is now found that no benzene is formed, toluene making its appearance as the lowest boiling member.

A paper "*On the Action of Water and of various Saline Solutions on Copper*," by Mr. T. CARNELLY, was then read by the Secretary. In his experiments the author employed thin copper-foil, which he cleansed by treatment with dilute nitric acid and washing with water. The pieces exposed 1 square decimetre of surface, and were treated with 100 c.c. of the liquid under examination. He studied the action of distilled water; of potassium and sodium nitrate; calcium, potassium, and magnesium sulphate; sodium and potassium carbonate; sodium and potassium chloride; and ammonium sulphate, nitrate, and chloride; also solutions of mixtures of salts. The copper was dissolved in all cases, but it would seem that the ammonium salts had a far more marked action than any others, on which account waters contaminated by sewage, and therefore, as a rule, containing comparatively large quantities of ammoniacal salts and chlorides, are especially bad where copper pipes, vessels, &c., are employed.

The last communication, by Mr. G. A. HIGHT, was "*Notes on some Experiments made with a view to ascertain the Practical Value of a Proposed Method of Determining the Mineral Strength of Soils by means of Water Culture.*" In these experiments plants were grown in a watery extract of the soil under examination, and the rate of growth carefully observed, the plants employed being seedlings of *Acacia Arabica*. The results are given in a long series of seventeen tables at the end of the paper.

Dr. GILBERT, in thanking the author for his paper, said that if this method were tried on plants of different habits it might lead to interesting results. He then adjourned the meeting until Thursday, May 18, when the following papers will be read:—(1) "The Action of Malt Extract on Starch," by Mr. C. O'Sullivan; (2) "On the Gases Enclosed in Cannel Coal and Jet," by Mr. J. W. Thomas; (3) "Phenomena Accompanying the Electrolysis of Water with Oxidisable Electrodes," by Dr. J. H. Gladstone and Mr. A. Tribe; (4) "On the Estimation of Hydrogen Occluded by Copper, with special reference to Organic Analyses," by Dr. J. L. W. Thudichum and Dr. H. W. Hake; (5) "On some New Reactions of Hemine, by Dr. Thudichum and Mr. C. T. Kingzett.

NOTICES OF BOOKS.

A Series of Exercises in Experimental Physics. By C. J. WOODWARD, B.Sc., and GEORGE SMITH, B.Sc. Part IA.—*Acoustics, Light, and Heat; Elementary Stage.* London: Simpkin, Marshall, and Co. Birmingham: Cornish, Bros.

THIS little work consists of a series of arithmetical exercises in which the student is taught to deal with easy physical problems, such as are often given in the elementary stages of the science and art examinations and the junior Oxford and Cambridge "locals." The authors have wisely refrained from adapting them for use with any particular text-book, as any of the ordinary manuals of physical science contains the necessary preliminary information. In cases, however, where the subject is more than usually difficult, some admirable preliminary remarks are made with the view of assisting the student, and a series of typical questions are completely worked out. Among the explanations we may point to that of the much misunderstood term "elasticity" as being especially good. The reputation of at least one of the joint authors as a successful teacher and ingenious experimentalist is well known, and we hope that "Part IA." will meet with such a reception as will induce the authors to continue their efforts to meet a real want.

Proceedings of the American Pharmaceutical Association at the Twenty-Third Annual Meeting, held in Boston, September, 1875. Philadelphia: Sherman and Co.

To us the most interesting portion of this bulky volume is the Report of the Committee on Adulterations and

Sophistications. It appears that we Englishmen are not the only people in the world, who, when wishing to purchase one thing, obtain in its stead some little-suspected impurity or other. The State of New Jersey appears to abound in manufacturers of essential oils who appear to make scarcely any secret of their illegitimate operations. There commercial oils of cedar, hemlock, and spruce are made by putting branches of the trees into the still along with an amount of turpentine proportionate to the price. The writer of the report states that he has on two occasions purchased four cans of oil of lemon, one lot of which contained 75 per cent of the true oil, and the other scarcely 33 per cent. Had the fraud not been detected the loss on the first lot would have been 75 dollars, and on the latter 175. "The writer recently had in his employ a gentleman who formerly held responsible positions in in two of the largest German houses dealing in essential oils. He exhibited to us a full line of receipts for mixing and cheapening all the more prominent oils, on which he placed great value and which he was very anxious to compound in this country." More recently the writer was informed by the representative of an extensive French firm, of Grasse, that all the cheap grades of lavender, rosemary, and origanum sent to America both by themselves and other houses contained as a minimum 75 per cent of turpentine.

Bees'-wax has been extensively sold in the Philadelphia market adulterated with 80 per cent of paraffin. The sophisticated article differs from the genuine in being somewhat translucent on the edges, and in being a little sonorous if struck. The paraffin may be separated by heating the wax for fifteen or twenty minutes with oil of vitriol to 350° F. The reporter has met with wax consisting almost entirely of a black, earthy matter coated externally with handsome yellow wax by dint of repeated dipping into melted wax.

CORRESPONDENCE.

ORGANISATION AMONG ANALYSTS.

To the Editor of the Chemical News.

SIR,—One of the chief causes which no doubt operates to render the profession of properly qualified analysts unremunerative is the large accession to their ranks of men who, with a *penchant* for practical science, seek this, the only profession exempt from examination a test of fitness, as the field of their labour.

Often, it may be, the *res angusta domi* obliges a man after one session of lectures and laboratory practice to take a situation in a chemical works at a starvation pittance, there to execute manœuvres in analytical chemistry marvellous to himself and probably disastrous to his employers. I have had some years experience in chemistry and could enlarge upon the subject of low fees.

What will Mr. Alldred say when I tell him that some little time ago an iron manufacturer offered the writer the privilege of making five full analyses of iron ore at the rate of 30s. per sample! He said he had never paid more than £2 2s., and that the usual figure was 30s.

I declined the offer. Possibly some one else accepted it and thus assisted to place this liberal patron of applied science in a position to abate the next man at least 10s.

I, with Mr. Alldred, do not suppose that the proprietors of some laboratories themselves make such analyses. Much they probably depute to voluntary assistants, who, with supervision, become expert mechanical analysts. When such a state of things exists it probably does pay to take in iron ores at £2 2s., or pyrites at 10s. 6d. per sample.

Your correspondent alludes to the injunction which Dr. Fresenius lays on the student who wishes to do his work thoroughly. I think, however, we must bear in mind that possibly, in some kinds of work, the rigid accuracy which the Doctor wisely instils is not always expected for the price paid. I do not, however, advocate slipshod analyses at any price.

I heartily wish an organisation scheme were on foot. It is monstrous that labour requiring such skill should be so miserably paid.

The overcrowding of the profession, and the fierce competition such a state of things entails, sadly wants the touch of reform.

The scheme suggested by Dr. Wright is excellent and would, I think, meet the requirements of the case. As at present there are analysts, and analysts, so will there always be penny wise and pound foolish merchants and manufacturers who will employ the "bottle-washer" and cheap man, whose crude and undigested results bring discredit on the whole profession. To protect ourselves against such we must "set our house in order" lest *forsitan et nostrum nomen miscebetur istis*.—I am, &c.,

P. H.

ORGANISATION AMONG CHEMISTS.

To the Editor of the Chemical News.

SIR,—If any organisation to introduce an examination prior to practice as an analytical chemist is to be carried out it is scarcely likely to receive legislative support unless the rights of those *now* in practice are respected. When medical examinations were introduced persons in practice were not in any way interfered with, and when "registration" was instituted they were permitted to register as qualified and to recover fees, &c. No retrospective measure was made, nor is it likely that the chemical profession will receive a larger share of power or protection than the medical. At present any one may prescribe or practise medicine, and provided he does not falsely assert he is registered he may do so safely even if unqualified. Examinations are excellent things in many respects, but chemists now in practice would be very unlikely to submit to them or the fees incidental thereto.

The Society of Public Analysts, if it became the Society of Analysts, would form an excellent nucleus for an organisation amongst analytical chemists, and there is really no reason why, after a certain date, this body should not institute examinations for admission to its membership and grant a diploma. The Society could select from its members very eligible men as examiners, and consists already of a sufficiently numerous body to constitute an organised association. The Society need incur no expense in the outset, the examinations being held say in the laboratory of one of the examiners in London. As a graceful act all existing "associates" might be constituted "members" without examination. Subsequently a primary examination for associateship should be instituted.—I am, &c.,

A PUBLIC ANALYST.

May 8, 1876.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances, de l'Academie des Sciences. No. 16, April 17, 1876.

New Researches on Pyrogenous Carbides, and on the Composition of Coal-Gas.—M. Berthelot.—The author finds that benzin, propylen, allylen, crotonylen, and teren are present in coal-gas.

Researches on the Elasticity of Air under Feeble Pressures.—M. E. H. Amagat.

Existence, Optical and Crystallographical Properties, and Chemical Composition of Microcline, a New Species of Triclinic Felspar with a Potassic Base.—M. des Cloizeaux.—The composition of this mineral is—

Silica	64·30
Alumina	19·70
Ferric oxide	0·74
Potash	15·60
Soda	0·48
Loss on ignition	0·35
	101·17

The specific gravity is 2·54.

Conclusions from the Actino metric Measurements made on the Summit of Mont Blanc.—M. J. Violle.—A mathematical paper.

Daubreite (Oxychloride of Bismuth), a New Mineral Species.—M. Domeyko. This mineral is an earthy mass of a yellowish or greyish white, containing a great number of crystalline lamellæ, opaque, and of a nacreous lustre. Its hardness does not exceed 2 to 2·5, and its specific gravity is 6·4 to 6·5. Its composition is—

Sesquioxide of bismuth ..	72·60
Sesquichloride of bismuth..	22·52
Water	3·84
Sesquichloride of iron.. ..	0·72
	99·68

Bulletin de la Societe Chimique de Paris, No. 7, April 5, 1876.

Reclamation with reference to a Paper by MM. Girard and Willm on the Methylated Violets.—M. Ch. Lauth.—In the issue of March 5, 1876, MM. Girard and Willm express themselves as follows:—"It is known that M. Hofmann has obtained mono-methylated rosanilin (very red violet) by the oxidation of methylanilin under the influence of cupric chloride and of trimethylated methylate of rosanilin (parma violet) operating in the same manner with dimethylanilin." MM. Girard and Willm appear, therefore, to ascribe to M. Hofmann the discovery of the methylanilin violets, and of the reaction from which they take their rise. My claim to this discovery has not been contested hitherto, and I think it my duty to reclaim my prior right, never doubting but these gentlemen will admit their error, which a simple examination of dates will suffice to show. MM. Girard and Willm add, in a footnote, that they admit the priority of M. Lauth, and that they merely ascribed to Dr. Hofmann the interpretation of the reaction.

Reclamation of Priority in favour of John Lightfoot.—M. A. Rosenstiehl.—The *Bulletin de la Société Chimique* has recently published a paper by M. Guyard "On the Formation of Aniline-Black by means of the salts of Vanadium, and on the Theory of the Formation of Aniline-Black." This memoir, which contains a certain number of interesting facts, has decided me to put in a reclamation of priority. M. Guyard ascribes to M. Pinkney the discovery of the remarkable influence of the vanadium salts on the formation of aniline-black. The latter gentleman has, in fact, patented the use of vanadium, the French patent bearing date December 4, 1874. But he who, to my knowledge at least, made known the influence of vanadium is the author of the discovery of aniline-black, John Lightfoot. The *Bull. de la Soc. Indus. de Mulhouse* (tome xli., p. 285) contains a paper by him, translated from the English by M. Brandt, which is completely decisive on this point: it was read in the session of Nov. 29, 1871. Lightfoot took for his starting-point my investigation "On the Part Played by Copper in the Formation of Aniline-Black" (*loc. cit.*, tome xxxv., p. 281), which had been read Nov. 29, 1865. I had shown, among other things, that if we touch with a plate of copper or brass in relief a tissue upon which has been just printed a mixture of chlorate of ammonia and of a salt of aniline we obtain black in the parts which have been in contact with the metal, *i.e.*, a black pattern on a grey ground. He repeated this experiment by placing upon cloth, prepared as just described, several metals which he left in contact for fifteen minutes. After this he hung up the cloth in a warm and moist place for twelve hours, and passed it through an alkaline bath. The most intense black was due to vanadium, the next to copper, then to uranium, and lastly to iron. It must be remarked that Lightfoot does not merely mention vanadium *en passant*. He recurs to it, so much had he been struck with the influence of this metal. His actual words are—"Vanadium, therefore, has still more action than copper, although the action of the latter is very decided." I will add but few more words to the above. Since 1871 no metal has been added to the list drawn up by John Lightfoot. Copper is commonly employed for aniline-blacks which are to be developed by hanging up: iron is used for steam aniline-blacks, whilst vanadium and uranium have just been patented by M. Pinkney. It follows that Lightfoot has had the merit of first calling attention to the metals whose influence upon aniline-black is utilised in practice.

Correspondence from St. Petersburg, Feb. 1/13th, 1876.—M. W. Louguinine.—M. Boutleroff, on behalf of M. Zinine, describes certain derivatives of lepidene. MM. Boutleroff and Wagner gave an account of the following researches from the labbratory of the University of Kazan:—On the addition of the elements of hydriodic acid to an organic compound, and on their separation, by M. Saytzeff; on the bromide of amylen, and on the amylic glycol of diethyl-carbinol, by MM. Wagner and Saytzeff; on the transformation of diethyl-carbinol into methyl-propyl-carbinol, by the same chemists; on the bromide of butylen and the butyl-glycol derived from normal butylic alcohol, by MM. Grabowski and Saytzeff. MM. Kanonnikoff and A. Saytzeff have unsuccessfully attempted to prepare a secondary alcohol containing the radicals, ethyl and allyl. M. Michael Saytzeff gives a preliminary communication on the preparation of diallyl-carbinol by the action of zinc and formic acid upon the iodide of allyl. M. E. Wagner has found that ethyl-methyl-carbinol is formed in the action of zinc ethyl upon acetic aldehyd.

M. Boutleroff gives an account of the following researches executed at the University of Moscow:—

M. Lebedeff has found that the synthetic pyrotartaric acid of Simpson is identical with the pyrotartaric acid obtained by distilling tartaric acid. M. Markovnikoff has found aceton in the urine of diabetic patients, and has studied the laws of the formation of direct combinations in non-saturated organic molecules.

M. Boutleroff, on behalf on M. Popoff, communicates a note on the oxidation of the isopropyl-hexylic aceton described by M. Foux.

The same chemist presented a memoir on the transformation of certain hydrocarbides of the ethylic series into the corresponding alcohols, and communicated researches on the milky juice of *Cyanitum acutum*, supposed to be poisonous to camels.

M. Kourbatoff, in his own name and in that of M. Beilstein, describes products obtained by the action of chlorine upon a solution of acetanilide in glacial acetic acid.

M. Latschinoff, on behalf of M. Koutcharoff, states that the action of an alcoholic solution of acetate of potash on monobromated ethylen, C_2H_3Br, gives rise to acetic ether and acetylen.

M. Menschoutkine, on behalf of M. Kern, describes the action of sulphocyanate of potash on a solution of the chloraurate of sodium. There is produced an orange deposit, which dissolves if gently heated. This reaction is very sensitive. In presence of sulphocyanate of potassium iodide of potassium does not precipitate the salts of palladium.

M. Mendeleeff communicates the results of his experiments on the coefficient of expansion of air under a con-

stant pressure, and points out the agreement between the properties of gallium, as actually discovered by M. Lecoq de Boisbaudran, and which he had deduced from his law of elemental periodicity for the hypothetical element, "eca-aluminium."

The papers referred to will be found at length in the ninth part of vol. vii., of the *Journal of the Russian Chemical Society*.

Blue Colouring Matters derived from the Mixed Tertiary Monamines.—MM. E. Willm and Ch. Girard.—This patent contains two series of operations. In the first are prepared the mixed tertiary monamines containing simultaneously phenolic radicals (such as phenyl, cresyl, naphthyl), and an alcoholic radical (methyl, benzyl, &c.), or an acid radical ((formyl, acetyl, &c.). In the second series these monamines are converted into blue colouring matters.

Preparation of the Mixed Tertiary Monamines.—The authors heat the following mixture in a cohobatory apparatus, provided with a worm to allow the condensed vapours to flow back into the generator:—

Diphenylamin	100 kilos.
Formic acid	30 ,,

The operation lasts thirty hours at a temperature between 120° and 160°. They next distil to drive off excess of formic acid, and rectify in a vacuum. A single distillation suffices to yield pure formo-diphenylamin. The same mixed monamine is obtained on heating diphenylamin directly with oxalic acid to 160° for ten to twelve hours. Aceto-diphenylamin is prepared in a similar manner by heating directly diphenylamin with glacial acetic acid in presence of a dehydrating body, such as chloride of zinc, fused acetate of potash, &c. It may also be prepared by the action of chloride of acetyl or anhydrous acetic acid upon diphenylamin dissolved by preference in glacial acetic acid. Lastly, it may be produced by the action of acetic acid upon formo-diphenylamin. This last procedure affords a general method for obtaining the mixed tertiary amines, setting out from formo-diphenylamin and an organic acid.

Transformation of the Tertiary Monamines into Blue Colouring Matters.—The authors heat 1 part of formo-diphenylamin and 2 parts of oxalic acid for twenty to twenty-two hours in a retort of enamelled iron to a temperature between 110° and 120°. In case of aceto-diphenylamin the temperature may be raised to 150°, or even 180°, without injury. To isolate the blue product the mass is run into benzin, decanted, and the insoluble residue taken up with boiling water in order to remove the excess of oxalic acid. They dry the residue, and dissolve it in strong alcohol, adding afterwards a small quantity of caustic soda so as to set the base of the blue at liberty, which is easily recognised, the alkaline solution being of a mahogany colour. It is then let cool, filtered, and the blue colouring matter precipitated by treating the solution with a current of dry hydrochloric acid gas. The hydrochlorate of the blue colour is precipitated, carrying with it the chloride of sodium formed at the same time, which is afterwards removed by washing with water. In this state the blue is pure. It may be easily rendered soluble in water by the action of sulphuric acid at 40° or 100°, according to the sulpho-conjugated compound which it is desired to obtain. For this purpose from 1 to 3 parts of acid are employed. These same blue colouring matters may also be obtained by the direct action of dry oxalic acid upon diphenylamin in presence of other organic acids, such as the formic, glacial acetic, tartaric, citric, butyric, valeric, benzoic, and, finally, phenol, &c. The proportions employed are, in general, equal parts of each body, the temperature varying from 120° to 160°, according to the nature of the acid employed. The authors append a new process for the direct production of these same blues in a soluble state. This consists in heating to about 120° a mixture of diphenylamin, of the compound intended to effect the substitution of the third atom of hydrogen, of oxalic acid, and of certain sulphates and bisulphates. The sulphates suitable are those of magnesia, alumina, of peroxide of iron, zinc, manganese, &c. Among the bisulphates those of potash, soda, and ammonia give good results. The following proportions, for instance, may be employed with sulphate of soda:—

Diphenylamin	100 parts.
Bisulphate of soda (anhydrous)..	100 ,,
Dried oxalic acid..	200 ,,
Glacial acetic acid	50 ,,
Sand	200 ,,

The glacial acetic acid may be replaced by fused alkaline acetates. As for the oxalic acid and the bisulphates they may be replaced, in certain cases, by the compound which oxalate of ammonia forms with concentrated sulphuric acid. The proportions given above may be modified according to the nature of the substances employed, or that of the blue to be prepared. To the sulphates indicated above may be added those of aniline, toluydin, and their homologues, and that of naphthylamin. To extract the blue from the product of the reaction the mass is washed with water to remove the excess of soluble salts and of oxalic acid: the residue is trested with a slight excess of ammonia, allowed to cool, and the blue is precipitated with a slight excess of sulphuric or hydrochloric acid. The precipitated blue, which is insoluble in a free state, is washed with water to remove the excess of the precipitating acid, and then dissolved in an alkali. The blue of commerce is then obtained on evaporation. The excess of diphenylamin which remains in the sand serves, when dried, for a new operation. A portion of the diphenylamin, not transformed, is also found as a sulpho-conjugated derivative in the mother-liquors obtained from the purification of the blue.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

Improvements in the production of electric light, and in apparatus therefor. S. A. Kosloff, St. Petersburg, Russia. February 5, 1875.—No. 441. Placing the carbons on insulators, introducing the metal wire into the carbon, and connecting it by hinges of metal; producing the nitrogen gas by rarefying the air in the globe by means of the lighted carbons, and letting the heated air escape; filling up the space in globe, and using an automatic mechanism for the passage of the electric current from one carbon to the other in case of breakage of one of the carbons.

Improvements in the manufacture of bread. J. H. Johnson, Lincoln's Inn Fields, Middlesex. (A communication from T. C. M. Huyttens, Gand, Belgium.) February 5, 1875.—No. 445. This invention has for its object the production of bread at a cheap rate, which, whilst equal in nutritive power and flavour to the higher priced best bread, shall be capable of preserving its freshness for a much longer period than the same.

Improvements in the manufacture of vinegar, and in apparatus to be used in the said manufacture. R. Pounsett, Milton House, Lindfield, Sussex. February 5, 1875.—No. 447. This invention consists in causing the air to pass on its way to the acetifying vats through refrigerating apparatus containing purifying and filtering materials.

An improved method of and apparatus for blowing glass. W. Smith, Salford, Lancaster. February 6, 1875.—No. 450. This invention relates to a method of blowing glass, wherein the glass is blown by means of air compressed into a suitable vessel by means of a fan or air-pump, instead of being blown by the breath from the lungs of the workman.

Improvements in the means and apparatus for manufacturing alkali, which improvements are partly applicable to other purposes. W. A. Lyttle, The Grove, Hammersmith, Middlesex. February 6, 1875.—No. 455. The features of novelty are as follows:—1. The reduction of sulphate of baryta to sulphide of barium by incorporating it in a powdered state with carbonaceous matter, making the mixture into lumps, and reducing it as specified in the method of reducing iron ores described in my Letters Patent of the 1st September, 1874, entitled "Improvements in the Manufacture of Iron and Steel." 2. Reducing the sulphate of baryta to the state of protoxide of barium, by incorporating the powdered sulphate with carbonaceous matter and powdered iron ore or ferric oxide, and making the mixture into lumps for reduction according to the method described in the Specification of the aforesaid Patent. 3. The production of powdered reduced iron in accordance with the provisions of the said Patent, and incorporating such powdered iron with powdered sulphate of baryta and carbonaceous matter as the means, under the action of heat, of withdrawing all the sulphur from the sulphate of baryta. 4. The use of hydrate of baryta thus prepared for the precipitation of sulphuric acid from all salts containing that acid, but especially from the sulphates of sodium and potassium.

THE CHEMICAL NEWS.

Vol. XXXII. No. 860.

NOTE ON CERTAIN HYDRATES.

By Prof. A. H. CHURCH.

Quite apart from mere accidental and hygroscopic moisture, we may find that essential or combined water is lost by hydrates of definite composition—this loss occurring in an apparently capricious manner. But in reality it is not capricious nor indefinite when the conditions under which it occurs are separately observed. It is not indefinite because it can be proved to affect one, two, or more molecules of water, and not some vague and variable proportion of that present in the compounds which suffer alteration. It may be studied in salts which are insoluble in water as well as in those which are soluble, and in amorphous as well as in crystallised compounds.

In a series of papers on mineralogical subjects, and more particularly in those which relate to native arseniates and phosphates, I have frequently pointed out the importance of studying the conditions under which combined water exists in minerals; the present note is intended to recall attention to the subject, and will be followed by a fuller report.

Such of the above phenomena as have been long known are included under the rather wide term "efflorescence," a term which seems applicable enough to the case of soluble crystals. When, however, as with insoluble transparent crystals, no change in the smoothness of the surfaces occurs, but the crystal becomes more or less opaque, then the term *nebulescence* may be used with advantage.

Now the three conditions which favour the attachment and retention of combined water are:—

1. A low temperature.
2. A moist air or medium.
3. A high barometric pressure.

And conversely,—rise in temperature, desiccation of the air, and removal of the barometric pressure cause the loss of combined water. In view of these facts, which have been long known but perhaps not duly considered in reference to insoluble salts, would it not be well to classify unstable hydrates after the manner introduced by Prof. Guthrie? His name, *cryohydrates*, will remain to designate compounds in which the water is retained through lowness of temperature; *hygrohydrates* retain their water only when moisture is present in the medium in which they are placed; while *barohydrates* retain their water through aërial pressure.

An illustrative example of a hygrohydrate and a barohydrate may now be cited. Autunite, the native uranium-calcium phosphate, contains, in its original condition, 10 molecules of water. In perfectly *dry* air, under the ordinary barometric pressure, it loses 5 aq. Thus altered the mineral has become a barohydrate, having originally been a hygrohydrate. For now it is only necessary to place the partially desiccated mineral *in vacuo* for it to lose 3 more molecules of water, the 2 remaining molecules being retained at 100°, which temperature causes no further loss. It is interesting to note that the nearly-related torbernite, though it loses nothing in dry air or *in vacuo*, yet retains but 2 aq. out of 8 after heating to 100° C. I have found several instances of hygro- and barohydrates amongst mineral species.

It is scarcely necessary to mention cases of soluble salts which are hygrohydrates efflorescing in dry air. But the recent observation of Mr. Crookes that alum effloresced in one of his radiometers shows that this salt is a barohydrate.

We are apt in the case of minerals to forget the extremely artificial conditions under which we preserve them, so different in pressure, in temperature, and in moisture, from those under which many of them have been formed.

CONDENSATION OF VAPOUR OF MERCURY ON SELENIUM IN THE SPRENGEL VACUUM.*

By R. J. MOSS, F.C.S.,
Chemical Laboratory, Royal Dublin Society.

In the course of experiments on the electrical conductivity of selenium, a cylindrical bar of this substance in the vitreous state was enclosed in a glass tube which was attached to the exhaust-tube of a Sprengel pump. The bar of selenium was 45 m.m. long and 3·5 m.m. in diameter. Platinum wires were attached to the ends of it and passed through the sides of the glass tube. The tube was exhausted, and allowed to remain attached to the pump for four days. It was now found that the selenium had acquired a conductivity greatly exceeding that of the pure element in its most highly conducting condition. The experiment was repeated with the intention of observing the time required to produce conductivity. In forty-two hours the needle of a highly sensitive galvanometer was slightly deflected, when the selenium was placed in the circuit of ten Leclanché cells. The conductivity of the selenium increased rapidly for four days, when the experiment was unavoidably interrupted. On admitting air to the tube no change of conductivity was observed. The selenium was unaltered in appearance, even when examined microscopically. On breaking the bar it was found that the conducting film was entirely superficial. It was not removed by rubbing forcibly with a cloth. Dilute nitric acid also failed to remove it. Bibulous paper moistened with solution of silver ammonio-nitrate was not stained by it. (Marget, *Comptes Rendus*, Dec. 11, 1871.) It therefore appears highly probable that the film does not consist of uncombined mercury. As it has not hitherto been known that mercury combines with selenium at ordinary temperatures, a bar of selenium was immersed in mercury and allowed to remain undisturbed for six months. At the end of this time it was found that the selenium was coated with a highly conducting film. I could not detect any difference between this film and those produced in the Sprengel vacuum. An attempt was now made to estimate the quantity of mercury required to produce the observed conductivity. A bar of selenium, 125 m.m. long and 2 m.m. in diameter, having platinum wires fused into each end, was enclosed in a glass tube, containing also a minute globule of mercury about 0·5 m.m. in diameter. The tube was exhausted by means of the Sprengel pump, and then hermetically sealed and detached from the pump. In ninety-two hours the bar began to conduct, and the conductivity increased rapidly from day to day for four days. On the fifth day, no increase being observed, it was supposed that air had leaked into the tube, and on examining it a flaw—which would account for the leakage—was detected. The tube was therefore again attached to the pump, exhausted, and again sealed, the defective portion being removed. The conductivity of the bar again increased from day to day, and is still steadily but slowly increasing (eleven days after the second sealing of the tube). Although the bar of selenium now possesses a comparatively low resistance, I cannot detect the slightest alteration in the size of the minute globule of mercury which has supplied the material for the conducting film, extending over a surface one thousand times greater than that of the globule.

* A Paper read before the Royal Society.

The granular modification produced by subjecting vitreous selenium to a temperature of 100° C. for three hours also acquires a great increase of conductivity when exposed to the vapour of mercury in the Sprengel vacuum.

As it is possible at any moment to arrest the formation of these conducting films, bars of selenium of any given high resistance may be obained in this way with great certainty and accuracy.

RESEARCHES ON THE SOLID CARBON COMPOUNDS IN METEORITES.*

By J. LAWRENCE SMITH, Louisville, Ky.

(Continued from page 191).

Chemical Character of the Graphitic Nodule.

When pulverised and heated in a short glass tube from 100° to 150° C., water is given off which is doubtless water absorbed from the air by the graphite. If heated a little higher and then brought close to the nose, a slight empyreumatic odour is apparent; if heated still higher, there is a slight odour of sulphuretted hydrogen. If heated in the open air the carbon is burnt with difficulty, showing its true graphitic nature.

Treatment of the Graphite by Ether.—Very pure and concentrated ether was added to 2 grms. of material in powder and rubbed up in a porcelain mortar; then poured into a small beaker; a little more ether was added and the two allowed to remain together for twelve or eighteen hours, the vessel being covered to prevent evaporation. The ether was then filtered off from the graphite, which was finally washed with a little ether. The ether was allowed to evaporate slowly in the uncovered beaker placed where the temperature was about 33° C. After the ether had evaporated, long colourless acicular crystals covered the sides of the vessel, and some shorter ones were in the bottom. There were also some rhomboidal crystals and rounded particles. The solid residue exhaled a peculiar odour of an aromatic character, somewhat alliaceous. The quantity of these crystals was small, not exceeding 15 milligrms. from 2 grms. of the graphite. Heated on a piece of platinum foil they fuse at about 120° C. Heated in a small tube closed at one end, they first melt and then volatilise, condense in yellow drops that soon solidify leaving a carbonaceous residue. They are not soluble in alcohol, but very soluble in sulphide of carbon. Fuming nitric acid oxidises the material, and gives, as one of the products, sulphuric acid. The quantity was too small to admit an ultimate analysis, but it was very evident that sulphur was the predominating constituent, the remainder being carbon and hydrogen. These three elements may be combined, forming a peculiar sulphydrocarbon, which in previous note I called *celestialite*, or it may be sulphur containing a minute quantity of a hydrocarbon that gives the peculiar odour and determines the somewhat singular form of crystallisation of the sulphur; for these acicular crystals may be only elongated rhombohedrons.

Be the compound what it may, it is a matter of chemical and astronomical interest that a solid graphite nodule thus encased in iron should contain a sulphydrocarbon, or free sulphur and a hydrocarbon.

The graphite powder, after treatment with ether, was then treated with bisulphide of carbon (which was re-distilled just before use), and after standing two or three hours was thrown on a filter; the filtrate was evaporated to dryness, and the residue was a yellow solid; in this instance, as in the last, the quantity was small. This, when heated in the open air on platinum foil to a red dull heat, first melts at about the temperature that sulphur melts, and finally the sulphur is burnt off, leaving a carbonaceous residue. When heated in a tube it sublimes, leaving a black residue.

To all appearances this is the same substance, or mixture of substances, that was extracted by the ether, the ether not having exhausted the graphite in the first treatment.

The graphite nodules of the DeKalb and of the Cranbourne irons, on treatment by ether and sulphide of carbon, gave similar results. In the case of the Cranbourne graphite I had less than 100 milligrms. of the material to operate with, and I hardly hoped to obtain satisfactory results, but I did succeed, however, in obtaining such without the acicular crystals, for the whole residue was less than 1 milligrm.; but I had enough to recognise the peculiar odour, and also the minute quantity that could be scraped off the vessel in which the evaporation took place furnished the marked reaction by heat of volatilisation in part and condensation of the same with a carbon residue. The Cranbourne graphite requires more trituration with the ether than that from the Sevier meteorite, as it is more flaky on being rubbed up.

Further remarks about this peculiar substance will be made a little farther on, when I come to speak of the same compound as obtained from the black or carbonaceous meteorites.

Action of Strong Nitric Acid on the Graphite.—Strong nitric acid, poured upon the powdered graphite that had been treated with ether and bisulphide of carbon, acted vigorously upon the sulphide of iron mixed with it, and after digestion for some time in the acid and washing thoroughly with water there remained 55 per cent of the original matter, which consisted of carbon. This burnt in air with great difficulty, but very easily in oxygen, leaving a residue of 1 per cent of ash.

The nitric acid solution was analysed and found to contain :—

Sulphur	35·05	Troilite.
Iron	62·21	
Cobalt	0·56	
Nickel	0·16	
Magnesia	0·30	
Silica	0 21	
	98·52	

It is a fact of some interest to remark that in the sulphide of iron which occurs in meteoric irons (when these nodules are perfectly free from any adhering iron) the quantity of nickel and cobalt present is very minute, a most singular fact if we are to regard these nodules as the result of segregations from the mass of iron. And still further, while the nickel is very largely the predominant metal of the two in the iron, I have noted that the cobalt predominates over the nickel in the sulphide nodules; but I would not without further examination regard this as likely to be the rule in all cases.

Action of Fuming Nitric Acid Mixed with Potash Chlorate on the Meteoric Graphite.—The oxidation of graphite by this method is well known to chemists, it having been first pointed out, as I have stated, by Brodie, in 1860, and subsequently by Berthelot in his elaborate memoirs published in the *Annales de Chemie et de Physique*, 4th series, vols. xix. and xxx. The result is the formation of a substance which Brodie called graphitic acid and Berthelot graphitic oxide, although the compound invariably contains hydrogen as an essential element in its constitution. M. Berthelot made use of this reaction to study the different forms of carbon, finding that the results of the oxidation varied with the carbon from different sources, only those forms of carbon known as graphites proper furnishing the graphitic oxide. The same chemist studied this oxidising action upon the graphite from the Cranbourne meteoric iron, and also upon the carbon from the Orgueil meteorite, and found that, of the two, only the graphite from the meteoric iron gave rise to the oxide.

The study of this subject I have pushed further, and have oxidised the graphites from the Sevier County and

* Communicated by the Author

the De Kalb County meteorites, and have also re-examined that of the Cranbourne iron—having been very liberally furnished with a specimen by my friend Prof. Maskelyne, of the British Museum. The carbonaceous matter from the Orgueil meteorites has also been subjected by me to the same reaction.

The details of conducting the process were identically those proposed by M. Berthelot in the memoirs already referred to, viz.:—To free the powdered graphite from sulphide of iron by first treating it with strong nitric acid, washing it thoroughly on a filter, drying it and mixing it with five times its weight of potash chlorate, then adding this mixture little by little to sufficient fuming nitric acid to moisten thoroughly the mass. In making the mixture, I place the nitric acid in a capsule, and the latter in a little water with a piece of ice, thus avoiding any risk of explosion. The mixture, after standing a few hours, is transferred to a *ballon d'assais*, and gently heated in a water-bath at a temperature from 50° to 60° C. for several days. The result of this action upon the graphites of the Sevier County and DeKalb County meteoric irons was the formation of grapitic oxide, with all the characteristics of that furnished to Berthelot by the graphite from the Cranbourne iron, as well as to myself from this last graphite.

The conversion of the meteoric graphite into the oxide is more rapid than that of any terrestrial graphite with which I have experimented. The graphite soon changes from black to green, and finally, after two or three applications of the oxidising agent, to a perfectly white substance. This, when filtered, washed, and dried under a bell glass with sulphuric acid, gives a yellow powder somewhat adherent. If the oxidising action of the nitric acid and potash chlorate be renewed several times on the same material, the oxide gradually diminishes in quantity, and if the process be stopped after the fourth or fifth treatment, the oxide is very gummy, adhering to the filter and preventing complete washing. When dried on the filter it adheres firmly, but can be detached by moistening the filter and rubbing off the paper with the finger, leaving tenacious flaky films.

The reaction and decomposition of the oxide obtained from the Sevier graphite is the same as that of the oxide from other sources.

My experiments on terrestrial graphites have been confined to the Siberian, Cumberland, and Ceylon varieties; and they show that the graphite under consideration differs from them in being more readily converted into oxide, it requiring only one-fifth to one-third of the time; and if the operation be continued by frequently renewing the oxidising agents, the oxide first formed gradually diminishes in quantity, being more thoroughly altered, like some of those forms of carbon ranked as not properly graphites.

In fact, it appears that the meteoric graphites, when tested by this process, occupy a place between graphites proper and ordinary carbon, but much nearer to the graphites.

After completing my examination of the carbon nodules of the irons, my aim was to see what general deductions could be made with reference to the relations this graphitic material bore to the carbon found in the black meteoric stones. The material to operate with is, however, very rare; but I had in my collection enough for all necessary comparisons, though needing much more in order to obtain the peculiar products in sufficient quantities for chemical analysis.

(To be continued.)

Modifications of Starch in Vegetables.—M. Mercadante.—The author does not admit the transformation of starch into gum. According to his observations, gum appears in the cellules simultaneously with starch, only the latter body fills the centre of the cellular mass, and the gum is distributed in concentric layers towards the circumference.—*Gazzetta Chimica Italiana.*

ON THE METHODS FOR THE VALUATION OF RAW SUGAR.

By H. C. HUMPHREY.

THERE being at present a certain amount of interest excited by a rumoured attempt soon to be made as regards a change in the tax on imported sugars, I have thought that it would not be amiss to write a short article, stating the views now generally entertained as regards the composition of raw sugar, and the most advanced ideas on the methods of the valuation of the same. Raw sugar as it comes into the market has the following composition:—

Cane sugar, or saccharose.
Glucose.
Inorganic salts.
Organic salts, gum, colouring matter, &c.
Water.
Insoluble substances, sand, &c.

Looking into the origin of the sugar, we may regard it as a mass of sugar crystals with a certain portion of the original mother-liquor or molasses adhering to it. The sugar crystals are pure saccharose. The mother-liquor is composed of a certain portion of saccharose, together with all the remaining substances mentioned above, except the insoluble sand, &c.

This mother-liquor or crude molasses, upon evaporation, would be found to deposit a certain quantity of crystalline saccharose which has been held dissolved by water. There would, however, be left a thick syrup, which would be found also to contain cane sugar which is held in solution, so to speak, by the impurities, and which it would be impossible to obtain by further crystallisation. This sugar has been noticed to differ from crystalline saccharose in its greater solubility in alcohol, but in other respects no difference has been observable. This sugar may be looked upon as an amorphous sugar. As sugar when melted loses its crystalline structure, so the action of the impurities exerts a somewhat similar effect.

We can now classify the saccharose as present in raw sugar in three forms:—

1. Crystalline sugar.
2. Crystalline sugar dissolved in water.
3. Amorphous or syrup sugar.

We will not enter into a detailed description of the methods used in distinguishing cane sugar, nor the usual tests for the various impurities, all that we wish to illustrate being the problem of the valuation of sugar.

In order to classify still more clearly the component parts of cane sugar we have four divisions:—

1. Crystals of saccharose.
2. Solution of crystals of saccharose in water.
3. Syrup. { Syrup sugar, Glucose, Inorganic and organic salts, colouring matter, &c.
4. Insoluble residue, sand, &c.

In estimating the value of sugars the first step taken was the grading according to colour, and the external characteristics. This is at present the method used in levying duties in this country. There is a series of coloured sugars called the Dutch standard, and all sugars are classed according to the number with which their colour agrees. It is only too well known how imperfect this system is. Sugars having 93 per cent of cane sugar are often classed with those having 83 per cent. It is likewise a well-known fact that high grade sugars are artificially coloured in order that they may be imported under the same duty as sugars of a very low grade. The only

property taken into consideration in this system is the colour, which is a matter of comparatively little importance when the constitution of the sugar is examined. It would, however, seem more advisable to look for a means of estimating the value to the saccharine matter, the sugar itself. For this purpose it was, and still is, to a great extent, the custom to take into account only the cane sugar, the amount of which is obtained by means of the polariscope. Sales are now made of molasses in this country on polarisation alone, and although the knowledge of the amount of cane sugar is of much more value than the simple physical appearance, yet the molasses refiners are well enough convinced that something more must be done to give a clearer insight into the nature of the molasses, and can appreciate how unsatisfactory is the valuation based simply upon the polarisation.

The first error which serves to vitiate this method is analytical in its nature. Sugar, and especially molasses, contains a certain per cent of glucose. Now glucose has a left-handed rotation of about one-third the effect of cane sugar. If, therefore, there is present 3 per cent of glucose there will be 1 per cent less cane sugar shown by the polariscope than there actually is. The 3 per cent of glucose has neutralised 1 per cent of cane sugar. This is the theoretical result, but I must confess that in the examination of sugars by inversion I have failed sometimes to find the error so great, which fact has been explained by considering the glucose to be partially present in an optically inactive condition. These cases have been with me the exception, as I have almost always found a greater amount of cane sugar by inversion than by what is called direct polarisation.

It was also found by the refiners, as soon as they began the use of the polariscope, that not only did the amount of refined sugar fall short of the amount melted, but also that it frequently happened that two raw sugars having the same amount of sugar by polarisation, gave, in the working, different results. These facts could only be explained by the supposition that there were losses occasioned in the process of refining, and also that different sugars had in them certain substances which served to destroy or render uncrystallisable the cane sugar contained in them. A great deal of attention has been paid by chemists and sugar-refiners abroad to the discovery of the cause of these losses. The conclusions arrived at have been various; some have considered that the molasses-making or "molassegenic" substances were the inorganic salts; others that the glucose, together with the organic salts and substances, were responsible for the injurious action; whilst others, that both acted, as it were, mechanically or physically to prevent crystallisation. It was therefore no longer possible to consider only the amount of cane sugar present; it was necessary to form some idea of how the sugar would work in the refining, or what influence the impurities would have in the working of the sugar. Many methods have been tried and recommended for this purpose. In 1864 a committee, representing France, Great Britain, Belgium, and Netherlands, tried experiments in a small refinery in Cologne. As a result of these experiments they found that the yield of the sugar could be calculated by deducting from the amount of cane sugar the amount of ash multiplied by 5. This conclusion was arrived at by the examination of the resulting syrups from which no sugar could be crystallised. In the analysis of these it was found that the ash bore a fixed relation to the amount of sugar contained in the syrup, and that this relation was 1 : 5. This coefficient 5 has been used in France and Belgium in estimating the value of raw sugars. Refiners, however, found that this coefficient was too high. In 1873 we find the Paris delegation to a conference on this subject proposing 3·5 instead of 5 as the correct coefficient. A number of other figures have been proposed according to results of different investigators. And it is very natural that the results should vary, as there was no distinction made between the losses due to mechanical losses in the refining and those which resulted from the impurities in the sugar.

It has likewise been proposed to subtract from the amount of the cane sugar the difference between that amount and 100.

By another method the sum of organic and inorganic impurities should be multiplied by 2, and the result subtracted from the amount of cane sugar. This result is then compared with the result of what is considered the standard sugar, namely, one which has the following constituents:—

Cane sugar..	93
Impurities	3
Water..	4

This standard would give a result of 87 per cent, and for every 1-10th per cent above and below this amount a certain charge is made.

Still others multiply the organic impurities by 4, and subtract the result.

All of these methods are founded upon an examination of the refining syrups, and it has been the object in view to exhibit what the injurious effects of the impurities may be in rendering uncrystallisable the cane sugar. They have been striving to discover the amount of syrup sugar. But the objection to them all is that they do not separate the losses due to the nature of the sugar and those incidental to the refining process. They likewise look upon the various impurities as exerting the same amount of injury. Thus, in the French system, all inorganic salts, whatever they may be, are considered in the valuation of the sugar to have the same effect, and that this should not be the case all recent experiments on the action of salts prove.

In 1871 a prize was offered by the "Society of Beet Sugar Industry of the Zollverein" for the solution of the problem of the estimation of the yield of refined sugar from cane sugar. This prize was awarded to Dr. Scheibler, who has made use of and perfected a method proposed by Payen. The principle of this method consists in the treatment of the raw sugar sample with alcohol of different strengths, saturated with sugar, and with an alcoholic acid solution. In this way all the impurities are removed without the loss of any of the cane sugar in the crystallisable condition. A weighed quantity is treated in the tubes or flasks with a mixture of ether and absolute alcohol. By this means the water present is removed, and any sugar which has been present dissolved in the moisture is precipitated. By the subsequent treatment with solutions of 96 per cent, 92 per cent, and the acid 86 per cent solution, the impurities, the syrup of the sugar is removed. There remains, then, the crystallisable sugar, together with the impurities, insoluble in solution. The amount of sugar is then determined in this washed residue. Having started with the sugar in these conditions, as—

1. Crystallisable sugar in solution of water,
2. Cane sugar in syrup, or syrup sugar,
3. Crystals of cane sugar,

we have, by the mixture of alcohol and ether, precipitated the first, which remains with No. 3, the crystal sugar, and have removed No. 2, the syrup sugar. There is therefore found as a result all the crystallisable sugar in the raw product. The glucose which might tend to affect the polarisation is also removed. This is simply an analytical process, the determination of the crystallisable cane sugar. It differs from the methods—such as the French and the others—above mentioned, in the fact that the result is obtained not by means of an arbitrary coefficient established by experiment made in the practical working of the refining, and which it is most difficult to correctly deduce, but purely by an analytical method. The result obtained does not claim to show the amount which will be actually obtained, but the maximum amount obtainable of crystal-

line sugar and the actual amount can be reckoned from this result, modified by a coefficient to represent the mechanical losses which occur in the refinery. This coefficient must necessarily vary in each refinery. The accuracy of this method has been carefully examined, and appears to be very reliable. One point of possible error is in the fact that the water in the sugar may so dilute the absolute alcohol that a certain quantity of the sugar may be dissolved. By the experiments of Brodenbeuler and Kohlrach it has been shown that in sugars having 3 to 4 per cent of water the loss occasioned is about 25 per cent. In very moist sugars, such as very often come from Porto Rico, in samples of which I have found as much as 6 to 8 per cent of water, it is advisable to dry the sample before treatment.

Two other questions also arise as regards this method:—1st. Whether sugar is deposited from the alcoholic solutions, and whether these solutions dissolve the crystallised cane sugar. 2nd. Whether all the syrup sugar is removed from the crystallised.

On the first of these points all who have tested the method are united in considering that there is no gain, provided sufficient precautions are taken in the execution of the analysis. Particular attention must be paid to keep the temperature of the room as constant as possible, otherwise a sudden change might cause crystals of sugar to be deposited, or, on the other hand, a solution of some of the sugar. It is also necessary to use the greatest care to preserve the solutions in a saturated condition. To effect this I have been in the habit of keeping them in bottles filled with rock candy or loaf sugar, furnished with a syphon, on the end of which is tied a linen filter. In order to prevent evaporation of the alcohol in the large bottle, I have employed a mercury valve attached to the chloride of calcium bottles, which serves to prevent any evaporation.

As regards the second point, the removal of all the syrup sugar, a number of experiments have been made to show the solubility of this in the acid solution. Amongst others who have worked upon this subject, L. Serruier (see Appendix to article on Saccharimetrie, by Dr. J. N. Gunning, *Scheibler's Zeitschrift*, band xxv., p. 435) has given some interesting results. He has mixed with refined sugar a certain quantity of syrups from which no more sugar could be extracted in the refinery. This mixture he has washed, and the result has shown no increase in the crystallised sugar, proving that the syrup has been dissolved. He likewise made mixtures of refined sugar with syrups from which certain amounts of sugar were calculated as obtainable in the refining. The results, as shown by Scheibler's method, corresponded very closely to the calculated amounts.

Duplicates made according to this method I have found to agree very closely, the result varying seldom more than a few tenths. I have had no opportunity to test the agreement of analyses made on the same sample by different chemists; but if all precaution is taken in the execution of the analysis they would probably agree very closely.

One objection appears to lie in the fact of too great time being consumed in the execution of the analysis. It takes about two hours for the analysis of a single sample; but of course with plenty of apparatus a very large number can be carried on in the same time. In the laboratory of Dr. Gunning, in Amsterdam, two assistants can finish in seven or eight hours fifty of these determinations. And if more time is consumed than in simple polarisation, there is also much more to be learned as regards the value of the sugar. On the whole, this method seems to be the most valuable of any yet proposed in fixing the value of the raw sugar. The colour of the sugar should also be taken into account, and then, with the knowledge of the condition in which the cane sugar is present, which is given by this method, a very clear idea is obtainable of the value of the sugar.—*American Chemist.*

PROCEEDINGS OF SOCIETIES.

PHYSICAL SOCIETY.

May 13th, 1876.

Professor G. C. FOSTER, F.R.S., President, in the Chair.

THE following candidates were elected Members of the Society:—Prof. T. Andrews, Rev. R. H. M. Bosanquet, M.A., and David Howard.

Mr. THOMPSON, B.A., B.Sc., concluded the communication on the supposed new force which he commenced at the last meeting of the Society. In the arrangement which he has adopted for obtaining the spark, the secondary current of a Rhumkorff's coil is made to traverse a short coil of wire, which is thorougly insulated from the internal core, and into the circuit an arrangement is introduced, by means of which the spark may be made to traverse a variable thickness of air in its course round the short coil. It is found that if this spark is very short the spark obtained from the internal core is also short; but as we increase the thickness of air to be traversed, the spark which may be drawn off increases. The greatest effect, however, is produced when one terminal of the coil is connected with the earth, the spark then obtained being about half an inch in diameter. Mr. Edison considered that the spark was retro-active, but Mr. Thompson showed by an experiment that deficient insulation might lead to such a conclusion. He then proceeded to show that just as the charge given to a gold-leaf electroscope is at times positive, and at times negative, without any apparent reason for the change; so if the core of the arrangement employed be connected with a Thomson's galvanometer the needle will be found to wander irregularly about the scale on both sides of the zero. In order to show that these experiments are identical with those conducted as originally described by the discoverer, the terminals of the induction coil were connected with the coil of an electro-magnet, the same means of including a layer of air in the circuit being introduced. The effect in this case was found to be precisely similar to that obtained with the special arrangement previously used. With a brush discharge a Geissler's tube could be illuminated, and when the layer of air was infinitesimal the spark produced was also infinitesimal. It was then shown that if the spark at the point of contact in the key when a direct battery current traverses the coil be done away with by shunting the extra current which gives rise to it, no spark can be obtained from the core. It thus appears that no spark is obtained when there is no necessity for an inducing current to accumulate until it has sufficient tension to leap over a resisting medium, and that, as the thickness of this resisting medium increases, the spark obtained becomes greater. Evidently, on these occasions, the charge has time to attract unlike and repel like electricity in the core, and if a conductor in connection with the earth be presented to this core the like electricity will escape: hence a spark will result. As soon, however, as the tension has become sufficient to leap over the layer of air it will be necessary to restore equilibrium in the core. Hence there will be a return spark in the opposite direction. From these experiments it will be seen that the phenomena observed may be explained by the ordinary laws of induction.

NOTICES OF BOOKS.

British Manufacturing Industries. Edited by G. PHILLIPS BEVAN, F.G.S. London: E. Stanford.

THE series to which this volume belongs promises to be both interesting and useful. Its object is to "bring into one focus the leading features and present position of the

most important industries of the kingdom, so as to enable the general reader to comprehend the enormous development that has taken place within the last twenty or thirty years." Of course, within the scope intended, minute working details cannot be given. What is aimed at is to gather together the leading facts connected with each branch and present it "in as readable a form as is compatible with accuracy and a freedom from superficiality."

The volume before us comprises treatises on acids, alkalies, soda, ammonia, and soap, by Prof. Church; on oils and candles, by W. Mattieu Williams; and on gas and lighting, by R. H. Patterson.

The amount of sulphuric acid produced and consumed at two large manure works alone is given as 32,000 tons per annum. On the other hand, 326,000 tons of common salt are annually decomposed in the alkali manufacture. As this requires about an equal weight of sulphuric acid at 1·6 for its conversion into salt-cake, Prof. Church's estimate of the annual production of sulphuric acid in the kingdom as "considerably over 100,000 tons," must be very far below the mark.

The manufacture of chlorine is ably described, the processes, old and new, of Weldon and that of Deacon, being explained. Under the head of nitric acid the author points out as important desiderata methods of preparing that acid and ammonia from the direct combination of their respective elements.

In treating of potassium and its salts Prof. Church describes the important change effected in the manufacture of potash by the discovery and utilisation of the Stassfurt deposits of sylvine, carnallite, and kainite. The amount of potash salts sent to market from Stassfurt alone amounts to 100,000 tons yearly, throwing the supply obtained from the incineration and lixiviation of vegetable refuse into the shade. It is greatly to be desired that some method could be found of substituting for potash in the manufacture of the chromates, ferro-cyanide, &c., some base of a lower value in agriculture. The scheme of obtaining potash as a by-product in the manufacture of beet-root sugar must ultimately lead to disastrous results. Potash is an essential part of the food of plants, and the supply existing in any soil is finite. If we then constantly take away potash from the soil and do not return it, the land will ultimately be reduced to sterility. A similar reflection applies to the potash obtained from grapes in the form of argol. The sketch of the modern alkali manufacture is accurate and fairly comprehensive. The manufacture of caustic soda, the processes for the recovery of sulphur from the vat-waste (which substance a certain patentee has thought fit to designate black-ash), the "ammonia process," and the preparation of soda from cryolite are all noticed.

A notice by the same author, of the "minor chemical products of Great Britain," suggests some very serious and not altogether pleasant reflections. At the risk of having our motives misconstrued we shall make a quotation:—"Although the United Kingdom maintains its pre-eminence over all other countries in the number and magnitude of its vitriol and alkali works, yet this is far from being the case with respect to factories devoted to the finer and more delicate preparations of the chemist. Here German, French, and Austrian manufacturers are ahead of our own, and still continue to make remarkable progress. If a rare and curious substance discovered by a scientific chemist and made in his laboratory painfully, grain by grain, be found useful in medicine, or dyeing, or some other art, straightway the foreign manufacturing chemist makes it, not by the ounce or pound merely, but by the cwt. or even by the ton. The success of foreign manufacturing chemists in this direction may be accounted for without difficulty. One reason is to be found in the cheapness of pure alcohol, or spirit of wine, so necessary in the preparation or purification of most of the products to which I am now referring, but I cannot help thinking that the chief reason is of quite a different sort. To foreign chemical works a sound, well-trained scientific chemist is attached with a salary of perhaps £300 or £350 a year. Sometimes several such chemists are employed by one manufacturer to improve old methods of manufacture and to discover new ones. According to Dr. Lunge, of the Newcastle Chemical Society, one German chemical factory has six assistant chemists (not practical managers) and one chief chemist, a distinguished man of scientific reputation, to whom is given a salary approaching £2000 a year, simply for investigation and original work in the laboratory, not for superintending the manufacturing operations. Two points connected with the products of these Continental factories are of special interest; one being the fact that much of the crude material necessary for making some of these products is exported from England for that purpose; and another point is that the original discoveries on which some of these industries have been based were made in our own country."

Is there an Englishman who can think of these "two points" without a feeling of humiliation? No one need accuse Prof. Church of "self-depreciation." Like ourselves he is fully aware that the British and Irish mind yields to no other in its natural aptitude for scientific research. But that mind finds at present little encouragement. The price of alcohol for technological uses might be reduced by legislation. In fact, the old act concerning methylated spirit, and conceived with especial reference to the varnish trade, sadly wants revising. National prudence or private munificence may supply us with schools of science as efficient as those of the Continent. But how are our manufacturers to be convinced that their present line of conduct is "penny wise and pound foolish"—that they are acting like a farmer who should endeavour to economise by stinting his land of the needful manure, and should yet expect to be a gainer? Our men of business laugh at foreign protectionists, and yet fall into errors still more absurd. Compare our English chemical works with those described above. In many there is no chemist at all, the proprietor relying on rule-of-thumb, laughing at all improvements, and losing heavily by waste and bungling. In many others there is a chemist starving on a miserable pittance, often placed in subordination to ignorant officials and his whole time taken up with routine duties. How under such circumstances are improvements possible? How is it that all the intellect of the country is not driven into other directions far less useful to the nation at large? We thank Prof. Church for having given utterance to the passage we have quoted, and we declare that if the book contained not another useful line, it would still deserve a place in the study of every statesman and every man of business throughout the country.

A Manual of Qualitative Chemical Analysis. By William Dittmar, Professor of Chemistry in Anderson's University, Glasgow. Edinburgh: Edmonston and Douglas, 1876.

Professor Dittmar is so well known as a painstaking teacher of chemistry that any book giving his views upon chemical analysis would be read with interest. But the present volume is something more than a mere patchwork of analytical methods, like so many of our so-called "Manuals," and may fairly claim to rank as one of the most complete works on qualitative analysis in the language. Although, of course, the general principles of the ordinary method of separating the metals are adhered to, we find evidences of the author's originality on every page. And Prof. Dittmar by no means limits himself to a description of the tests for the commoner metals and salt radicals, but discusses in their proper places such bodies as selenium, tellurium, lactic acid, &c. The properties and reactions of the various sulphur acids and of the compound cyanides are given remarkably fully.

Prof. Dittmar employs but few formulæ, and when used they express the composition of the substances they repre-

sent in the simplest possible way. In nomenclature, however, the author is somewhat inconsistent. On pages 124, *et sequitur*, we meet with the names "caustic potash," "hydrate of lime," "sulphate of barium," sulphate of baryta," "oxalate of ammonia," "sal-ammoniac," "oxalate of calcium," "arsenite of lime," &c., together with the formulæ $BaSO_4$, $(NH_4)_2C_2O_4$, &c. The above want of method causes some obscurity, and might easily have been avoided.

The author does not confine himself to a mere description of the reactions of each substance, but introduces much general matter of the utmost value to a true student. Thus, under lithium, we have the mode of occurrence, the properties of the metal, the oxide anhydrate, the carbonate, chloride, nitrate, sulphate, and phosphate.

On page 142 there is an elaborate table showing the solubilities of all the more important salts of potassium and sodium, together with notes respecting the corresponding compounds of rubidium and cæsium.

Although the author does not ignore organic substances entirely, we should have been glad to see a little more space devoted to their recognition. There is scarcely a work in which the student will find a distinct well arranged method of detecting organic bodies other than a few of the leading alkaloids and acids. Chemistry is probably scarcely in a condition at present to allow of any definite mode of procedure in the case of organic mixtures, but there are numerous well defined organic bodies with characteristic properties, and it is a misfortune that for their recognition the student is left to his own resources instead of receiving assistance from the recognised professors of chemical analysis.

On the whole, the author has succeeded in compiling a work of the highest value to the intelligent student and even to the professed chemist. The book teems with comparatively little known facts, and while showing that chemical analysis is by no means so easy to master as some suppose, the true principles of the craft are enunciated in a manner which reflects high credit on Prof. Dittmar. The book should be in the hands of every worker at chemical analysis.

A Class-Book of Chemistry. By Edward L. Youmans, M.D. London: Henry S. King and Co.

In his preface the author says this book is not designed as a manual for special chemical students, but is intended to meet the wants of a considerable class who would like to know something of the science, but are without the opportunity or the desire to pursue it in a thoroughly experimental way. There is little doubt that such a book is needed, and the author has been fairly successful in accomplishing the task he has set himself.

About one-third of the book is occupied by a clearly written outline of chemical physics, spectrum analysis forming the subject of a specially long chapter, illustrated with some new and very superior woodcuts. Of course, the limited space at the author's disposal compels the imperfect treatment or entire omission of many points of interest to the general reader, but, on the whole, the subject matter is well chosen.

In the portion of the book devoted to chemical theory we think the author has not been so happy. Remembering the class of readers for whom the book is avowedly intended, graphic formulæ of manganic hexa-fluoride and "potassic-aluminic sulphate" appear somewhat out of place.

The arrangement of the elements in the "descriptive chemistry" is somewhat peculiar, though founded chiefly on the current notion of quantivalence. As the perissad elements are all considered before the artiad, potassium, gold, antimony, &c., are discussed before the reader is introduced to oxygen.

An outline of organic chemistry, and numerous questions on the subject-matter, conclude the book, with the exception of a list of technical words accented so as to show the author's pronunciation of them. From this we find that the acid of vinegar is the a-cet'-ic. Co'-balt, mer'-cu-rous, o-le-fi'-ant, per-is'-sad, are among the instances given, while among the proper names we find Jole (Joule), Keerk'-hoff (Kirchhoff), Shay'-lay (Scheele), and many others which are often mispronounced.

Though not free from faults, we can recommend the book as one which will well repay perusal by those for whom it is intended.

CORRESPONDENCE.

ORGANISATION AMONGST CHEMISTS.

To the Editor of the Chemical News.

Sir,—I observe, from the correspondence begun by Dr C. R. A. Wright, that chemists are at last finding out the necessity for organisation. The reasons which he urges in favour of this can, I think, be fully confirmed by every chemist.

I am sorry to note, however, that he makes little mention of that class of chemists who are employed in various chemical and metallurgical works: some of these doubtless are what he terms bottle-washers—men who have learnt to do some of the common routine work of a laboratory, but who would be utterly at sea if they had an analysis to do that was a little out of their common run; but at the same time there are many chemists employed in works who have gone through a good training, who have, besides the common work of a laboratory, which is often done by an assistant, many questions put before them for their solution which require much more knowledge and skill than a bottle-washer can have gained,—questions which concern the economy and improvements in the manufacturing processes of the works; besides, the analyses placed in the hands of works' chemists are fully as important, and demand quite as much accuracy, as any placed before commercial analysts.

The letter by Mr. Alldred expresses the feelings of works' chemists very well: their position has been rapidly degenerating, and has been combined with clerk, &c. I know, from my experience, that there are plenty of hammermen, steel-melters, and furnace-men, in iron, copper, and other works, who have a considerably larger salary than many chemists. I agree with him that it is undesirable for members of the proposed Guild to be obliged to know Latin, German, or French: some of us have learnt these and other things, but from disuse would not be able now to pass an examination.

Merchants and others requiring chemical analyses and advice frequently comment upon the discrepancies occurring between various analysts. Not very long ago so great an authority in the iron trade as Mr. I. Lowthian Bell, in one of his speeches, spoke words to the effect that it was seldom he could find two chemists' results to agree: many who heard him will doubtless throw the whole blame on chemists as a body, but these people do not seem to think they are in the least degree to blame themselves, in screwing chemists down to such low fees that will not pay for honest work.

The proposed Guild would, I hope, remedy such a state of matters as this, do away with the disgrace of having "high" and "low" analysts, regulate fees, and make them such as shall fairly remunerate honest work and do away with the slipshod work that exists at present.

I myself will strongly support this movement, though I cannot agree with Mr. Allen that the Guild should be founded on the Society of Public Analysts; I believe it should be a separate Society. I fear the hardest work, in starting at least, will fall upon the metropolitan chemists;

but they may rest assured, I believe, of the hearty co-operation of their provincial brethren.—I am, &c.,

G. S. P.

Glasgow, May 12, 1876.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances, de l'Academie des Sciences. No. 17, April 24, 1876.

Coal-Gas and Pyrogenous Carbides.—M. Berthelot.—Coal-gas passed through a column of pumice saturated with concentrated sulphuric acid yields a liquid which separates into two layers, the one formed of sulphuric acid more or less modified, and the other of a mixture of hydrocarbides. This mixture amounted to 25 grms. per 100 cubic metres. On being submitted to three series of fractional distillation it was resolved into—

Benzin with a little toluen	2
Mesitylen (160° to 170°), $C_{18}H_{12}$	5
Cymen (180°), $C_{20}H_{14}$	20
Tricrotonylen (220° to 240°), $C_{24}H_{18}$	30
Colophen (300° to 320°), $C_{30}H_{24}$	32
Residue fixed at 320°	5
Intermediate products and loss	6
	100

Pyrogenous Decomposition of Nitrate of Ammonia, and on the Volatility of Ammoniacal Salts.—M. Berthelot.—Nitrate of ammonia melts at about 152°. It is only above 210° that it begins to decompose sufficiently to yield an appreciable volume of gas. The decomposition becomes more and more active as the temperature of the melted salt is raised, without the heat stopping at any fixed point between 200° and 300°. If the temperature is raised the reaction becomes explosive. The amount of protoxide of nitrogen collected falls always far below the theoretical amount in consequence of the volatility, real or apparent, of the nitrate of ammonia. This salt may be sublimed without destroying it perceptibly if it is placed, previously melted, in a capsule covered with blotting-paper, and surmounted with a cardboard cylinder filled with large fragments of glass. The capsule is then heated in the sand-bath, care being taken that the temperature shall not exceed 190° to 220° C.

Vegetation of Plants not endowed with Chlorophyll.—M. Boussingault.—Not suitable for abstraction.

Researches on the Sugar Beet.—MM. E. Fremy and PP. Dehérain.—Saline solutions identical in composition act very differently upon beets accordingly as the roots plunge into the solutions themselves, or as the latter merely occupy the pores of the soil. On planting beets of different origin in identical conditions as to soil, manure, and watering, roots are obtained differing in their yield of sugar. An excess of nitrogenous manure lowers the percentage of sugar in all beets, but those of a superior strain preserve still such a quantity of sugar that they may be advantageously treated. To produce from a given surface the maximum of sugar under conditions advantageous alike for grower and manufacturer, we must depend above all on a judicious selection of the seed.

Interchange of Ammonia between Natural Waters and the Atmosphere.—M. Th. Schlœsing.—Not suitable for abstraction.

Electric Variations of the Muscles, and in particular of the Heart, studied by means of the Electrometer of Lippman.—M. Marey.

Certain Compounds of Titanium (Third Paper).—MM. C. Friedel and J. Guérin.—The authors admit only two nitrides of titanium, Ti_3N_4 and TiN, or rather Ti_2N_2. The existence of Ti_3N they consider hypothetical.

Electric Primers.—M. P. Ris.—The author proposes to render induction-primers conductive by incorporating with a detonating mixture, having a base of chlorate of potassa, a small quantity of platinum sponge.

New Process for Determining Astringents.—M. F. Jean.—The author has observed that astringents mixed with an alkaline carbonate absorb the solution of iodine with a readiness like that of the arsenite of soda. This absorption is directly proportional to the quantity of astringent matter present, 1 part of dry tannic acid taking up 4 parts of iodine. The solution of iodine required for the titration of tannin is obtained by dissolving 4 grms. of iodine in iodide of potassium, and making up the solution to 1000 c.c. with distilled water. To standardise this solution place in a precipitating glass 10 c.c. of a solution of tannin containing 0·1 grm. per cent, add 2 c.c. of an alkaline solution containing 25 per cent of crystalline carbonate of soda, and then with a graduated burette drop the solution of iodine into this mixed liquid till a drop of the mixture, taken up with the stirring-rod, and placed upon a leaf of starch-paper produces a very slight violet spot, which indicates the presence of free iodine and the end of the operation. The value thus obtained must be corrected, that is to say, from the number of c.c. of solution of iodine corresponding to 0·1 grm. of tannin must be deducted the volume of the solution required to produce the coloured reaction upon starched paper. For this purpose 10 c.c. of distilled water are measured out, mixed with 2 c.c. of alkaline solution, and the solution of iodine is then added, drop by drop, till a spot is obtained upon the starched paper. With a solution containing 4 grms. iodine per litre the correction is generally 0·1 c.c. for a volume of 10 to 12 c.c., but the greater or less purity of the carbonate of soda may make a slight variation in this correction. To 0·01 grm. of tannin dissolved in 10 c.c. of water it is generally necessary to take 10·5 c.c. of a solution at 4 per 1000. The paper used is white filter-paper, covered by friction with a slight layer of powdered starch. For ordinary determinations tannic acid may be taken as the type of the active principle of astringent bodies. But if a high degree of accuracy is required the solution should be standardised with a pure sample of the astringent body under examination, catechuic acid being used in case of catechu, morintannic acid for fustic, &c. Crystalline gallic acid decomposes the solution of iodine in the same proportion as tannic acid. If it is desired to determine these acids separately, we first find the joint amount of tannic and gallic acids, and then, operating on a fresh portion, remove the tannic acid by means of rasped hide or gelatin and alcohol, and determine afresh the gallic acid remaining. The tannic acid is then found by subtracting the second result from the first. The extractive matters found in astringents do not interfere.

Cyanide-Cyanate of Chloral.—C. O. Peck.—This compound is the only instance known at present of the property of the hydrocyanic and cyanic acids to form addition products with an aldehyd.

On Sulphur in Coal-Gas.—A. Verigo.—The author found, in portions of 100 cubic feet of gas made at Odessa, respectively 2, 1·81, 1·9, 2·01, and 2·2 grms. of sulphur. He readily detected the presence of sulphurous acid in the air of rooms lighted with this gas, and demonstrated its ready conversion into sulphuric acid in contact with moist organic matter, such as cotton yarn.

Bulletin de la Société d'Encouragement pour l'Industrie Nationale, No. 28, April, 1876.

Present State of the Sugar Manufacture in France, and on Certain Experiments concerning the Function

of Lime in the Process of Defecation.—M. Lamy.—The author declares that during the last season, though the beet-root has been abundant, the yield of sugar has been unusually poor, and the prices far from remunerative. He ascribes the latter evils to over-production and to the Excise Duty. He complains that French beets yield only 5 to 6 per cent of their weight, whilst those of Germany and Austria produce 7 to 8. As regards the action of lime, he finds that the amount of lime dissolved in a saccharine solution increases as the temperature falls, just as with pure water. In pure saccharine solutions the amount of combined lime is greater than could be dissolved in water alone at the same temperature, even at 100°; but it is still much lower than the quantity that would be required to form a monobasic saccharate between the limits of 30° and 70°.

Reimann's Farber Zeitung,
No. 13, 1876.

This issue contains a continuation of a paper on cochineal; accounts of the state of the tinctorial trades in France and Prussia; a notice of disputes between the editor and two of his contemporaries; and a number of dyeing and printing receipts.

No. 14, 1876.

This issue contains the conclusion of the paper on cochineal.

Among the promiscuous intelligence it is reported that a silk garment which was being cleansed with benzol became spontaneously ignited!

A new dressing is announced under the name of *parementine*. It consists of 100 parts glue, 20 dextrin, 20 glycerin, 20 sulphate of magnesia, and 20 sulphate of zinc, with the needful amount of water.

A quantity of "weighted" or "loaded" silk having become useless by the spontaneous development of heat, the owner demanded compensation from a fire insurance company from whom he held a policy, and recovered the sum claimed by a legal decision.

Artificial Orchil.—Orcein, the tinctorial principle of orchil, is now said to be obtained artificially from one of the constituents of coal-tar. According to the French patent of Vogt and Henninger, toluol, $C_{14}H_8$, is converted into toluolo-bisulphuric acid by the action of concentrated sulphuric acid. It is then treated with lime, and again with an excess of soda, at 300°, either with or without pressure. The melted mass is dissolved in water, saturated with hydrochloric acid, the solution concentrated, and the chloride of sodium removed by crystallisation. The mother-liquor contains orcin, $C_{14}H_8O_4$, which on treatment with ammonia is readily converted into orcein.

No. 15, 1876.

This issue contains a paper on the effect of frost upon colours. It was observed by Kœchlin that woollen cloth dyed blue with indigo was notably decolourised by being allowed to freeze. This result, according to the experiments of Goppelsrœder, was due to ozone present in the air, which acts even at temperatures below 0°, but only when the tissue is wet. Cochineal reds on wool were decidedly impoverished by exposure to the action of ozone for eight days, but were not discharged. Aniline-black was unchanged; aniline-brown on cotton was turned an orange-yellow; magenta, aniline-blues and violets, coralline and iodine green were discharged, as were also lakes of the dye-woods, and even Turkey-red. Ozone is of great importance in the development of certain colours. Aniline-black, made up with hydrochlorate of aniline, sal-ammoniac, thickening, sulphide of copper, and chlorate of potash, was developed by the aid of ozone in 1 to 1½ hours. For the development of ozone on the large scale Goppelsrœder proposes Gramme's machine, in which the electric spark passes through a conductor repeatedly interrupted. The injurious effects of frost upon alizarin paste, alumina, gelatin, cochineal lakes, mordanted tissues, &c., are well known, but by no means thoroughly understood.

Dyeing with Artificial Alizarin.—Forster proposes to add a fatty acid to the colour, in order to produce upon cotton with artificial alizarin a red resembling Turkey-red. He mordants with alumina, and dyes in an alizarin bath containing soap, neutralised with sulphuric acid. The mixture of alizarin and fatty acid which separates out in fine flakes dyes the tissues readily, and gives bright and solid colours—red, rose, and purple.

At a meeting of the Berlin Dyers' Association, Dr. Reimann pointed out the absurdity of many of the statements made concerning the use of poisonous colours.

Gazzetta Chimica Italiana.
Anno vi., 1876, Fasc. ii.

Elasticity of Metals at Different Temperatures.—G. Pisati.—In this second paper the author treats of the elasticity of torsion, at different temperatures, in wires of silver, iron, steel, copper, brass, gold, platinum, and aluminium. It consists in great part of tables, and requires the accompanying illustrations.

Production of Ozone during the Nebulisation or Pulverisation of Water.—Prof. Guiseppe Bellucci.—The author made a series of observations at the cataract of Terni, both when the river (Velino) was full and when it was very low. He finds that the formation of ozone during the pulverisation of water is in direct relation with the amount of the water and with the rapidity of its nebulisation.

Synthesis of Propyl-Isopropyl-Benzol.—E. Paterno and P. Spica.—A preliminary notice.

Absence of Leucin among the Products of the Germination of the Graminaceæ.—M. Mercadante.—The author found leucin absent in the germinating seeds of wheat, barley, oats, and maize.

Les Mondes, Revue Hebdomadaire des Sciences,
No. 13, March 30, 1876.

Dr. Ponza proposes to submit lunatics to the action of blue or violet light. He has communicated to the Medico-Psychological Society of Paris the details of some cases in which this remedy has been employed with success.

M. Coinsin-Bordat has invented a new bleaching paste, which is strongly praised; its nature is kept a secret.

Nos. 14 and 15, April 6 and 13, 1876.

These issues contain no chemical matter.

No. 16, April 20, 1876.

The death of M. Balard, the discoverer of bromine, is announced.

A firm at Marseilles have found a new use for furnace-slag and vitreous lavas, in the sophistication of sugar.

No. 17, April 27, 1876.

The chemical matter in this issue consists of a receipt for making baryta-green, a manganate of baryta. There is also a reprint of the "recommendations" of the Royal Rivers Pollution Commission.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

New or improved modes and means for smelting ores and metals. A. Ure, Glasgow, Lanark, N.B. February 6, 1875.—No. 456. The nature and novelty of this invention consist, first, in distributing the air more uniformly round the furnace by tuyeres, the area of which is

reduced to a size to give sufficient air to burn the carbon, and in the case of cupolas, or re-melting furnaces for iron and steel, the air is passed through an annular chamber in the upper part of these furnaces to be heated before being led to the tuyeres; secondly, in making the smelting part of the furnace parallel or cylindrical from near the charging doors down to the tuyeres; and, thirdly, in charging the coke or coal into the centre of the furnace, and the ores or metal to be melted are placed round about the coke, and between it and the side of the wall of the furnace (in contradistinction to the usual mode of charging the coke and coal into the middle of the furnace), which effects great saving of coke. The coke or coal may be charged into the furnace in the positions referred to, either by hand or by conducting spouts above the ordinary charging door, angled to ensure the charging of the coke into the centre, while the iron is charged through the usual door around the charge of coke. Or a hollow rising and lowering cone might be hung to an actuating lever in the centre of the furnace, and which, after charging the coke, might be lowered on to the coke, and the ores or metal then thrown over the cone to ensure their annular distribution round the furnace.

An improved copying ink-pencil. H. Vollmer, Manchester, Lancaster. (A communication from A. Schultz, Berlin.) February 6, 1875.—No. 460. The object of this invention is to produce a pencil which can be used on all kinds of paper, the writing of which shall be indelible, and which shall give off an exact copy when a sheet of damp paper is put upon it and pressure applied, and this the inventor accomplishes by a combination of chemicals and black-lead moulded or pressed into the form required.

Improvements in the application of electro-dynamic machines for obtaining metals from their salts, regenerating galvanic batteries, and obtaining other chemical reactions. W. Clark, Chancery Lane, Middlesex. (A communication from D. F. Lontin, Paris.) February 8, 1875.—No. 473. The invention consists (1) in the utilisation of the whole of the electricity produced by an electro-dynamic machine for decomposing metallic salts from which it is desired to obtain the metal. (2) In obtaining most of the metallids by dynamo-chemical decomposition. (3) In producing organic and other chemical products by like means. (4) In regenerating spent galvanic batteries by a current from an electro-dynamic or dynamo-chemical machine.

Improvements rendering timber for building and other purposes impervious to dry-rot and decay, also rendering the same uninflammable. T. Jones, Harewood, Calstock, Cornwall. February 9, 1875.—No. 482. The object of this invention is to render timber for building and other purposes impervious to dry-rot and decay and also uninflammable. This is done by impregnating the timber with a hot solution of tungstate of soda. The solution should be of a certain specific gravity. Subsidiary details are described in the Provisional Specification.

Improvements in solid and liquid disinfectants and deodorizers. H. L. Jones, Webster's Hotel, Ely Place, Holborn, Middlesex. February 10, 1875.—No. 492. This invention relates to disinfecting powders and solutions, and consists in a combination or mixture of mineral sulphates and chlorides of the earthy salts, especially the combination of sulphate of zinc with chloride of sodium or of calcium. The salts are powdered and mixed in the proportions of 10 per cent of sulphate of zinc to 90 per cent of chloride of calcium. For liquid disinfectants this same powder is dissolved in water in the proportions of 1 lb. of the powder to each gallon of water, and it is coloured by the addition of a small quantity of aniline-blue.

Improvements in the means or apparatus employed in melting, refining, converting, and puddling iron. W. Middleton and P. Hayward, both of Leeds, York. February 10, 1875.—No. 493. Between an ordinary puddling furnace and chimney there is a retort for containing the cast metal before conveying it to puddling furnace, the metal in retort being heated by waste heat from puddling furnace. For refining is introduced a blast into retort.

Improvements in operating with indigo in the printing of cotton and other fabrics. T. Holliday, Huddersfield, York. (A communication from A. Schultz, Paris.) February 10, 1875.—No. 498. The invention relates to fixing colouring matter when employing indigo in the printing process by a steaming process, and consists in the use of indigo-white and oxide of tin, or salts of tin, and an alkali and gum for the purpose.

Improvements in effecting the bleaching of cotton and other fabrics produced from vegetable fibres. T. Holliday, Huddersfield, York. (A communication from A. Schultz, Paris.) February 10, 1875.—No. 499. The invention relates to effecting the desired bleaching of the fabric without the necessity for the use of caustic lime, as at present adopted. The fabric is submitted successively to the action of a weak solution of hydrochloric acid, to a washing and boiling in solution of resin-soap, to chloride of lime, to a further weak solution of hydrochloric acid, with washings in water between the operations. Some of the processes may be repeated, and the proportions and relations may be varied.

An improved process for extracting copper, silver, and other metallic compounds from solutions, and for separating the metals. G. J. Snelus, Workington, Cumberland. February 10, 1875.—No. 500. This invention for the treatment of solutions relates to the separation of the silver and gold as well as to the precipitation of the copper contained in such solutions, whether obtained directly from ores or otherwise.

Improved mode of and means for increasing the adhesion of locomotive wheels on rails. P. Jensen, Chancery Lane, London, (A communication from E. Bürgin, Basle, Switzerland.) February 11, 1875.—No. 506. Locomotive driving axle is covered with coils of insulated copper wire, the wheels being the poles of a powerful electro-magnet.

Improvements in the method of and in apparatus for drying, calcining, roasting, or incinerating soda-ash, sulphate of soda, and carbonate of potash, and ores of sulphur, copper, zinc, and lead, and applicable also in the treatment of other salts, ores, and substances. R. Milburn, Pomeroy Street, New Cross Road, Surrey, and H. Jackson, Park Square, Leeds, York. February 12, 1875.—No. 518. The inventors employ a travelling chain of scrapers to move the substances along a bed over which the flames from a furnace pass. The bed is supported on beams, so that the chain can return below the said bed. Some of the scrapers are caused to revolve in bearings in the chain links. The chain has a to and fro motion in addition to its progressive movement.

MEETINGS FOR THE WEEK.

Monday, May 22nd.—Royal Geographical, 8.30.

Tuesday, 23rd.—Civil Engineers, 8.
— Anthropological Institute, 8.
— Royal Institution, 3. "Wheatstone's Discoveries," by Prof. W. G. Adams.

Wednesday, 24th.—Society of Arts, 8. "Railway Safety Appliances.' by F. J. Bramwell, C.E., F.R.S.
— Geological, 8.

Thursday, 25th.—Royal Institution, 3. "On Voltaic Electricity," by Prof. Tyndall, D.C.L., LL.D., F.R.S.

Friday, 26th.—Royal Institution, 9. "Verification of Modern Scientific Theories," by J. F. Moulton.
— Society of Arts, 8. (Indian Section). "Competition and its Effects on Education, with especial reference to the Indian Services," by Dr. George Birdwood.
— Quekett Microscopical Club, 8.

Saturday, 27th.—Physical, 3.
— Royal Institution, 3. "King Arthur," by Prof. H. Morley.

BRITISH ASSOCIATION for the ADVANCEMENT of SCIENCE, 22, Albemarle Street, London, W. The NEXT ANNUAL GENERAL MEETING will be held at GLASGOW, commencing on WEDNESDAY, September 6.

President-Designate.

Prof. T. ANDREWS, M.D., LL.D., F.R.S., Hon. F.R.S.E.

NOTICE to CONTRIBUTORS of MEMOIRS.—Authors are reminded that, under an arrangement dating from 1871, the acceptance of Memoirs, and the days on which they are to be read, are now, as far as possible, determined by Organising Committees for the several Sections before the beginning of the Meeting. It has therefore become necessary, in order to give an opportunity to the Committees of doing justice to the several Communications, that each Author should prepare an Abstract of his Memoir, of a length suitable for insertion in the published Transactions of the Association, and that he should send it, together with the original Memoir, by book-post, on or before August 16, addressed thus:—"General Secretaries, British Association, 22, Albemarle Street, London, W. For Section....." If it should be inconvenient to the Author that his Paper should be read on any particular day, he is requested to send information thereof to the Secretaries in a separate note.

G. GRIFFITH, M.A.,
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THE CHEMICAL NEWS.

VOL. XXXII. No. 861.

EXPERIMENTAL CONTRIBUTIONS TO THE THEORY OF ELECTROLYSIS.*

By ALFRED TRIBE,
Lecturer on Chemistry in Dulwich College.

THE author first briefly traces the history of electrolysis from the discovery by Nicholson and Carlisle of the decomposition of water by the pile, down to the Bakerian Lecture of Sir H. Davy in 1807.

Grotthus contended that, since in the elementary combinations of the pile of Volta, as in a magnet, there is polarity, it would establish a like condition in the elements of water. To this Faraday added the necessary idea of the revolution of the molecules of the electrolyte.

If the condition of an electrolyte just prior to, and in the act of, decomposition be in accordance with these views of Grotthus and Faraday, an electrolyte may be regarded as a dielectric whose molecules are possessed of the power of mutually exchanging their constituents during discharge. This view, jointly with some supposed points of resemblance between magnetic and electrolytic substances, led to the experiments detailed in the communication.

Experiment I.—A piece of thin copper wire about an inch long was suspended lengthwise, by a piece of cotton, between the copper electrodes (distant about 4 inches) of a Grove's battery, and immersed in a 5 per cent solution of potassium chloride. Gas was at once given off from the end of the wire facing the positive pole, and after the lapse of a few minutes the end facing the negative battery pole was found corroded.

Experiment II.—Four thin silver strips were supported lengthwise in a line between copper electrodes in a 5 per cent solution of copper sulphate mixed with a little potassium chloride. On making contact, silver chloride immediately formed upon the ends of the strips facing the negative pole, and descended in clouds, being apparently attracted towards the battery poles. Copper was deposited upon the other ends.

The preceding experiments demonstrate that an insulated conductor immersed in an electrolysing fluid may become endowed with the power of doing work exactly similar to that done by the battery poles; *may*, because, as is subsequently shown, the working power of the insulated conductors depends upon its length, position in the fluid, and conductivity, as well as chemical activity.

The action is easily explicable upon the supposition that the battery electrodes charged with electricity polarise the insulated conductor through the electrolyte, just as static electricity polarises an insulated conductor in air, the difference between the two phenomena being that a high electric tension is necessary to effect the depolarisation of the particles of air by discharge, which, of course is unaccompanied by decomposition; whereas only a very low electric tension is required to effect the depolarisation of an electrolyte, which, on the contrary, is always accompanied by decomposition.

Experiments III. *and* IV.—A series of twelve strips, half-inch by quarter-inch, were supported in line as in the last experiment, the electrodes reaching all the way across the trough (which was 12 inches long), and being one-eighth inch distant from the end strips. A determination of the amount of copper on each of the strips showed that the amount of decomposition was equal throughout the length.

* Abstract of a Paper read before the Royal Society, February 17, 1876.

Experiments V. *and* VI.—Upon replacing the broad electrodes by others only half an inch wide very different results were obtained. The action was a minimum at about the middle of the line, and rose towards each end, but being about twice as great at the positive as at the negative electrode. With the exception of this difference at the two electrodes these experiments are explicable upon the hypothesis of Grotthus. The influence of the *direction* in which the strip is inserted is shown. When placed across the line joining the electrodes it has no action, nor does it interfere with the action of the other strips.

Experiment VII.—The amount of action is shown to increase rapidly with the length of the strip.

Experiment VIII.—Pieces of glass, charcoal, and platinum were supported in solution of copper sulphate. On connecting the copper electrodes with the battery it became evident that the platinum gave the greatest action, the charcoal a little, and the glass none. This illustrates the effect of conductivity.

Experiment IX.—The influence of the chemical activity of the strips was determined. These numbers were obtained for the relative activity:—

Zinc	19·5
Aluminium	15·2
Copper	1·7
Lead	1·6
Silver	1·3
Platinum	1·0

Experiment X.—By the use of strips distributed throughout the liquid, the lines of discharge between electrodes of small dimensions are investigated, and the electric influence is shown to spread out from the electrodes in a manner much resembling the spread of the magnetic influence in the magnetic field of two dissimilar poles.

NOTES ON THE ALLEGED REPLACEMENT O ELECTRO-POSITIVE BY ELECTRO-NEGATIVE METALS IN A VOLTAIC CELL.

By WILLIAM SKEY,
Analyst to the Geological Survey of New Zealand.

IN a paper by Prof. Gladstone, Ph.D., F.R.S., and Mr. Alfred Tribe, which was read before the Royal Society on November 25th, 1875, it is asserted that when zinc and platinum are connected voltaically in a solution of chloride of potassium, "potassium is set free in some form against the platinum, manifesting itself by the presence of free alkali and hydrogen gas;" and the authors of this paper, upon the supposition above stated, and others based in a similar way, argue for the replacement of electro-positive by electro-negative metals under conditions quite contrary to those we have hitherto held to be necessary, explaining this "reversion," as they term it, by assuming that some force superior to that of chemical affinity operates for its production, and which is "called into existence by contact."

I will not here discuss the propriety of resurrecting the "contact theory," which I thought Prof. Faraday had long since disposed of; but I would like to make a few observations upon two statements which appear in this paper.

In the first place, as far as I can understand from the abstract of it given in *Nature*, it is by no means clear that "potassium is set free" in the experiment described. The alkaline reaction upon which this theory of metallic reduction is based may in reality be due to a cause quite different from that of such a reduction. For instance, an alkaline reaction can be readily obtained under circumstances which are similar to those related here, except that "contact" in a voltaic arrangement with dissimilar metals is avoided, and under which it appears impossible that any metallic reduction takes place. Thus an aqueous solution

of chloride of potassium, placed for a short time with amalgamated zinc, or for a longer time with zinc itself, even at common temperatures, becomes very alkaline. Even pure silver in a solution of this salt soon passes it to this condition.* The containing vessels in my experiments for this were agate.

This change in the character of these solutions is hardly wrought by metallic reduction, but rather, in the first case, by decomposition of water and the formation of ammonia (by the interaction of the nascent hydrogen thus liberated upon nitrogen present), assisted perhaps by the formation of oxide of zinc by atmospheric oxidation, resulting finally in the formation of an oxychloride of this metal through substitution. In the second case, that of silver, we have its direct oxidation by the free oxygen present and the reaction of this oxide upon the salt present, chloride of silver and caustic potash resulting, to which last compound, of course, that alkalinity is induced which we observe.

In the case of zinc, it may be that the actions which result in alkalinity of the saline liquid surrounding it may not be so simple as I here suppose, for the investigation seems to be required ere we can fully explain them; but still the results I have here described, and several others I could cite of an analogous nature, certainly tend to show that the conception of metallic "replacement," as given in this paper of Prof. Gladstone's, is as yet scarcely a tenable one, or at least that it requires for adequate support considerably more evidence than has yet been tendered in its behalf.

With regard now to the next statement I have here to remark upon, viz., that mercury and gold in conjunction would decompose mercuric chloride, with deposition not only of lower chloride but also of metallic mercury, I will take leave to suggest, in explanation of this, the possibility of floating dust or other impurities, or even light itself, interfering with what should be the legitimate results of the experiment described. In support of this view I found that mercury, which for utmost purity I had electro-deposited from its potassic cyanide upon platinum, gave a deposit upon gold of mercurous chloride only, in presence of mercuric chloride when kept in the dark and away from dust.

I may state here that the detection of either mercurous chloride or mercury seems greatly facilitated by using platinum in place of gold for the receiving-plate, as this metal (platinum) loses greatly in lustre by minute traces upon it of such chloride, and any mercury present is easily rubbed off upon an angle of gold, and thus readily identified.

Using this modification of Prof. Gladstone's apparatus, I was only able to get, even in sixteen hours, a deposit of mercurous chloride which was so exceedingly thin as not to perceptibly impair the lustre of the platinum upon which it had formed: its presence, in fact, would not readily be detected except by the slight darkening of this platinum in caustic potash. By the addition of hydrochloric acid, however, to the mercuric chloride, thicker deposits of this kind were obtained, but none of mercury.

The deposit of this mercurous salt though, even alone, under the circumstances described by these investigators, appears to be a very suggestive phenomenon, and this because it appears inexplicable as at first viewed. I can only attribute this deposit to the action of a free acid or of free acids upon the mercury; a minute quantity of nitric or nitrous compounds dissolved in the solution used (taken from the air) would certainly be competent to act upon mercury to the extent required for producing mercurous films such as I have obtained.

However, in regard to this deposit, and that chemical action upon mercury by some free acid which I consider necessary for its production, I find that hydrochloric acid, even, readily attacks mercury when the metal is paired voltaically with platinum or graphite: now, as it is certain that these metals initiate or facilitate this attack by reason of the oxygen condensed (chemically) upon their surfaces, and, further, as gold will also certainly possess a similar though a faster condensing power over this gas, we must consider the possibility of part of the mercurous deposits produced in all these experiments being due indirectly to the metals used in them for the negative or receiving pole. In such experiments we may safely assume that a portion of the hydrochloric acid present has been decomposed, the oxygen condensed upon the negative element oxidising its hydrogen, while the chlorine of this compound attacks the mercury. It is, in fact, a case where both poles conspire to give an effect (that is, the decomposition of hydrochloric acid) not producible by either pole separately; and it may, as now known, throw a light upon the mode in which chemical action is so frequently facilitated, or even at times initiated, by touching the positive metal with a metal negative to it in the solution we may be operating with.

It appears to me that this matter is well worth investigating.

* "Oxidation of Silver and Platinum by Oxygen in Presence of Water." *Trans. of N. Z. Institute*, vol. viii.

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

Progress in the Artificial Production of Cold and Ice.
By Dr. H. MEIDINGER.

(Continued from p. 194.)

ACCORDING to experience hitherto, the air machines seem better adapted for the immediate application of cold air than for concentrating and storing up cold in the form of ice, in which respect they fall too far short of the ammonia machines. They may probably be found serviceable in breweries for cooling cellars. Motive power is always to be found in such establishments with which the air-pumps can be readily connected. The introduction of cold air into the cellars secures further the advantage that they are kept very dry by means of this air, which during its compression and expansion has been to a great extent deprived of its moisture, and hence no mould is formed. Cooling with ice, on the other hand, saturates the air of cellars with moisture, and keeps it stagnant. The whole process can be carried on in breweries at a relatively small expense, as in such establishments much heat and especially much hot water is required, and thus both the escaping steam and the hot water obtained by cooling the compressed air can be utilised. An air machine supplied by Mehrlich and Co. to Hildebrand's brewery at Pfungstadt, near Darmstadt, has given for a year very satisfactory results. The principle of the air machine seems also especially adapted for ventilation where it is desirable to combine reduction of temperature with renewal of the air, as in hospitals, public rooms, and steamships. Here a trifling expansion and a small degree of cold would suffice, and hence the working cost would appear relatively low. We may look forward with interest to the further development of this subject.

We have still to make mention of a more extended theoretical investigation which Linde† has given to the public on the "withdrawal of heat at low temperatures by mechanical agencies." The main result which he has arrived at in the way of calculation—which, however, appears at once on an attentive physical consideration of the changes that take place—is that for the economical working of ice machines the temperature of the body used as a medium during expansion must not be lower, and during compression not higher, than is absolutely necessary.

* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzenends."

† Linde, *Bayer. Industrie u. Gewerbeblatt*, July, Nov., and Dec., 1870.

This condition has hitherto been frequently overlooked, and ignored. Whilst it has frequently been said, in explaining the merits of an ice machine that it works at such or such low temperatures, the very opposite should be the case; it should be shown that the machine produces ice without requiring a temperature far below the freezing-point of water. The above-mentioned praise is merely a certain proof that the machine consumes much power needlessly. Certainly in this case the machine may be smaller and the first outlay easier, but this advantage generally vanishes in comparison with the drawback of increased working charges. Linde proves by calculation that in a theoretically perfect machine, which produces ice at −3° from water at +10° C., 1 kilo. of coal should yield 100 kilos. of ice. He combines also with his theoretical researches a critique on all ice-machines hitherto constructed. All makers of such machines should make themselves thoroughly masters of the principles here developed, which would keep them from going astray.

In 1873* J. Armengaud communicated certain theoretical speculations on air-machines to the French Academy, which, however, contained nothing essentially novel. He lays especial stress upon the importance of cooling the air during compression by means of water. The difficulty of effecting this by means of water injected in the moment of compression he overcame by introducing into the air, as drawn in, water, by means of Gifford's injector, probably as fine spray. According to his experiments it is most advantageous to work with a degree of expansion =2, in which case the power exerted, in proportion to the cold produced, is only half as great when the refrigeration is carried on during compression as if executed previously.

Nature of Artificial Ice.—Ice rapidly produced, at a very low temperature, is quite opaque and of a milky white. From this appearance—so different from the vitreous, transparent aspect of natural ice—the strangest conclusions have been drawn as to its behaviour. Sometimes it was assumed to be more and sometimes less permanent, sometimes to have more and sometimes less cooling power than natural ice. The truth is that artificial and natural ice differ merely in appearance. A piece of the former just taken out of the machine is of course colder than a block from the ice-cellar, and consequently melts rather more slowly on exposure to the air. Equally large pieces of natural and of artificial ice, at the same temperature, melt with equal speed under similar external conditions, and exert equal refrigeratory powers.

(To be continued.)

RESEARCHES ON THE SOLID CARBON COMPOUNDS IN METEORITES.†

By J. LAWRENCE SMITH, Louisville, Ky.

(Concluded from page 197).

The Alais Meteorite.

Two grammes of this meteorite were pulverised finely and treated with boiling water, which dissolved out a small amount of matter that has been studied by others, and which it is not my object to recur to here.

The powder was then dried and treated with pure ether in the same manner as the graphite from the Sevier iron, and the ether allowed to evaporate slowly at a moderate temperature, when the sides of the vessel became covered with acicular crystals, mixed with a few rhomboidal crystals. The residue had a peculiar odour, similar to that of the ether extract from the graphite of the Sevier iron, which odour it nearly lost in the same way, after several days exposure to the air. The form and appearance of the crystals are the same as those obtained from that graphite; and a portion of the crystals detached aad heated in a small tube gave the same character or reaction.

These crystals have already been studied by Prof. Roscoe, of Manchester, as carefully as could be done with the minute quantity at his disposal. My examination is perfectly in accordance with his, and there is no doubt that this product and that from the graphite must be of the same nature.

We must not forget to mention that Prof. Wöhler was the first to call attention to the hydrocarbon in these black meteorites when examining the one which fell at Kaba.

Orgueil Meteorite.

This meteorite is one of the most interesting of all the known carbonaceous meteorites, and there are one or two points connected with it that do not appropriately belong to this paper of which I will furnish a note before long. Through the liberality of Prof. Daubrée, and the Administration of Garden of Plants, I have been furnished with the material on which my investigations have been made. This meteorite has, in most respects, been thoroughly examined by M. Cloez, and by M. Pisani, and their results given in the *Comptes Rendus* for 1864. The former chemist examined the carbonaceous matter as a whole, considering it to resemble humus; and this, on drying at 110°, gave him:—Carbon, 63·45; hydrogen, 5·98; oxygen, 30·75.

I have, as yet, done little toward the re-examination of this substance, which represents from 4 to 6 per cent of the entire meteorite, my examinations being made principally for those crystalline products soluble in ether and bisulphide of carbon, of which I have found about one-half per cent in the meteorite.

The powdered meteorite was first treated with water and heated over a water-bath, and everything soluble in that menstruum thoroughly washed out. The soluble portion dried at 100° C., represents 8·65 per cent of the mass. After carefully drying the insoluble portion at 100° C., it was treated with ether in the same manner as the meteoric graphite. The ether was used in large excess, and allowed to remain for ten or twelve hours in contact with the material; the ether was filtered off, and the residue on the filter well washed with ether. The etherial solution was evaporated slowly, when the same acicular crystals made their appearance as in the case of the graphite, and numerous rhomboidal crystals were deposited in the bottom of the beaker. These appeared to be identical with those from the graphite. The action of heat on these crystals is the same as on those from the Sevier graphite.

The powdered meteorite exhausted by the water and ether was next treated by the bisulphite of carbon, when an additional quantity of soluble matter was obtained. On evaporating the bisulphite of carbon, a yellow mass remained having the aspect of sulphur. This, when heated, gave evidence of being sulphur mixed with some carbon compound, and to all appearance it was just like the substance obtained by similar treatment of the meteoric graphite.

The crystals in the upper part of the vessel from which the ether was evaporated being detached by scraping the sides of the vessel with a horn spatula, some bisulphide of carbon was poured upon the portions remaining attached to the vessel by which it was dissolved, and the bisulphide of carbon was subsequently evaporated, when a residue was left consisting of a yellow solid surrounded by a dark brown semi-solid mass in minute quantity. This last is evidently a carbon combination not contaminated with sulphur, while the yellow mass is sulphur containing a small portion of the carbon compound.

I was enabled to obtain over 400 milligrms. of these mixtures from about 50 grms. of the meteorite, much the larger portion being sulphur. A few attempts were made to separate the sulphur from the carbon compound, but

* Armengaud, *Comptes Rendus*, lxxxvi., 626. Dingler, *Polyt. Journ.* ccviii., 174.

† Communicated by the Author.

unsuccessfully; and I soon saw that by continuing my efforts, I should exhaust the small supply of material without reaching any useful result. So it was thought better to save what was left of the material as a specimen of it.

The other carbon meteorites I have not yet examined with regard to the points embraced in this report, but I hope to obtain sufficient material before long to allow of this being done, though I do not anticipate any different results from those that have been examined.

The Nature of the Hydrocarbon found in the Meteoric Graphite and Carbonaceous Meteorites.

That this substance belongs to the meteorites at the time of their fall there can be no doubt; for in the carbonaceous meteorites there is nothing to enable us to account for its formation in the cabinets in which they have been placed after their fall: and in the case of the graphite nodules they were encased in the interior of an iron mass over 20 c.m. in diameter; and, furthermore, the powder operated with was taken from the interior of a compact nodule of graphite.

I have been strongly inclined to consider this as a hydrocarbon containing combined sulphur forming a sulphydrocarbon. In the absence of chemical evidence sustaining this view, I lay some stress on the peculiar odour of the ether extract, strengthened by a most singular property of the watery extract from the Orgueil meteorite, of which I will make a short statement, reserving for some future occasion any additional remarks.

If a small quantity of the powdered Orgueil meteorite, say 2 grms., be treated with water and heated for a short time over a water-bath, no peculiar odour will be observed however carefully examined. Throw this on a filter and wash with water, then evaporate the filtrate to dryness over a water-bath, and during this time no odour will be observed; allow the residue to cool, and still there is no odour; but now throw upon the residue a little water, say ½ to 1 c.c., move the capsule around to dissolve the mass, and then on bringing it near to the nose, a marked alliaceous odour will be perceived, sometimes so strong as to be disagreeable, reminding one of the odour of the oil of assafœtida. That it is produced by a sulphur compound chemists will be apt to admit, perhaps a minute quantity of sulphur compound, not unlike the sulphydrate of ethylene, $C_4H_6S_4$, and the needle-shaped crystals may not be far removed from the solid quintisulphide of ethylene, $C_4H_6S_5$, corresponding to sulphur 75·00, carbon 20·00, hydrogen 5·00. The crystals I scraped from the sides of the beaker—at the upper part—on which the ether solution of the Orgueil meteorite was evaporated to dryness, gave:—Sulphur, 79·65; carbon, 15·00; hydrogen, 3·00.

In the above analysis the amount of sulphur is well determined; but the examination for carbon and hydrogen was made upon so small a quantity that the results cannot be relied upon as very correct.

Roscoe burnt in dry oxygen 0·008 grm. of the residue from the Alais meteorite, and obtained 0·010 grm. of sulphurous acid, 0·008 grm. of carbonic acid, and 0·003 grm. of water, making sulphur 125 parts, carbon 54 parts, hydrogen 10.

As the above analysis was made with only 8 milligrms., of course the results can be considered only as an approximation; but nevertheless, until we get better they must serve as our only guides.

I have not said anything about the gaseous carbon compounds found in meteorites, as these form a separate study from what is designed in this paper, and besides, Profs. Graham, Mallet, Wright, and others have already studied their nature. Profs. Wright and Mallet are still engaged in this line of investigation.

Conclusions.

These, then, are some of the results of my experiments on the carbon of meteorites, and they are of great interest and importance. That we should find in the graphitic concretions from the interior of a solid mass of iron such substances as free sulphur and a hydrocarbon, simple, or combined with sulphur, having a marked odour, was certainly not to be expected, especially as we are almost forced to believe that the iron containing it must have been at some period in a state of fusion.*

The graphite nodules themselves are grand chemical and physical puzzles, as well as all the nodular concretions in meteoric irons; that they have resulted from a process of segregation is self-evident, but how marvellous the completeness of this segregation, for if we analyse the iron, even within 2 or 3 m.m. of the concretions, only traces of the characteristic constituents of the nodules are here found. Then, again, in the case of the troilite concretions, this sulphide has been separated from the mass of iron, and a phosphide of iron and nickel has been concreting along with it; and yet there seems to be that incompatibility between these two minerals so that they could not commingle, but the phosphuret is thrust, as it were, to the exterior of the nodule, forming a thin covering to the sulphide, like the skin of an orange over the internal pulp.

Again, the graphitic concretions bear no resemblance to the scaly graphite found in the slag of iron furnaces and between the crystals of cast-iron, either in structure or appearance; the fractured surface is more like that of the Borrowdale graphite, but the oxidising action of the nitric acid and potash chlorate on this last differs somewhat from the action on the meteoric graphite. Many and varied have been the hypotheses formed in my mind to account for the formation and accumulation of this graphite, but I must admit that I have been forced at last to abandon them all, as none covers all the facts of the case. In appearance this graphite is more like the amorphous carbon that is separated from cast-iron, but the oxidising action of the nitric acid and chlorate of potash at once points out their great difference as seen by Berthelot's experiments;† and although it differs in appearance from the scaly graphite of iron, the oxidation of the two are very similar. I am more inclined to adopt the suggestion of Berthelot, that it may be formed by the reaction of bisulphide of carbon upon incandescent iron, as this reaction is known to give rise to an amorphous graphite analogous to the one under consideration, and its association with sulphide of iron would lend some support to this hypothesis; and still further the presence of free sulphur and a carbon compound, either a hydrocarbon or sulphydrocarbon, points also in that direction for a solution.

It is very clear from the present accumulated knowledge of the geological occurrences of graphite that we must abandon all attempt to account for its formation by any one series of reactions on the interior of our globe; for it is to be found in basaltic rocks, in the older crystalline rocks, and through all the series of rocks up to the recent tertiary formations, and when we add to this the laboratory experiments of Berthelot that I have so frequently quoted, this view of the subject is strengthened. But on this point I may have something more to say in a paper on the Ovifak iron, and the graphite in the basalt in which this iron is found.

The carbon from the black meteorites, as the Orgueil, Alais, &c., I consider as having a similar origin to that found in the irons; for I have proved that they both contain similar crystalline products soluble in ether and sulphide of carbon, and while the carbonaceous matter reacts differently when treated with nitric acid and potash chlorate, this may arise from the difference of conditions under which the reaction took place that gave rise to it.

That the carbonaceous matter in the black meteorites is

* In an article recently published by Dr. Mohr (*Annalen der Chem. und Pharm.*, Dec., 1875, p. 257), he advances the theory that meteoric iron and meteoric stones have been formed by the agency of water; his arguments are interesting, but far from being sufficiently convincing to cover all the facts in connection with meteorites.

† *Annales de Chem. et de Physique*, Fourth Series, T. xix., p. 425.

to be regarded as a kind of humus arising from organised matter is contrary to all we know about humus. For if we examine the mineral constituents of these meteorites we find them to be a granular mass, with particles more or less impalpable, composed essentially of olivine and pyroxene, a most unpromising soil for so luxuriant a growth of vegetation as must have occurred to produce so abundant a percentage of carbonaceous matter as that found in the Orgueil meteorite. The action of caustic potash upon it is very different from the action of that alkali upon what is commonly called humus (although we must bear in mind that humus is not a well-defined substance, it being commonly regarded as vegetable matter that has not undergone complete decomposition into water and carbon, but by imperfect oxidation is converted into a varied mixture of carbon and certain organic compounds rich in carbon, some of them soluble in caustic alkalies). After the powdered Orgueil meteorite has been exhausted by water, ether, and sulphide of carbon, caustic potash or soda dissolves but an exceedingly minute trace of the carbonaceous matter, and even that trace may be a little hydrocarbon not extracted from the mass by the ether and sulphide of carbon. If a portion of the same be dried at 110° C., and then heated in a closed tube, water will not be given off until the temperature is elevated considerably. If the temperature be further increased, only a very slight odour is apparent; and this is another marked difference between it and humus. If heated on platinum foil the carbonaceous matter burns off very readily with little or no odour, leaving an abundant residue. According to my experiments this combustible matter amounts to about 4·5 per cent of the entire meteorite.

It is not at all improbable that the carbonaceous matter of the black meteorites approaches in character the so-called hydrated carbon first pointed out by M. Eggertz, but so clearly defined by MM. Schutzenberger and Bourgeois in a communication made to the Chemical Society of Paris, in April, 1875, which was obtained from white cast-iron by dissolving away the iron. But it is a question, in my mind, whether the carbon combination thus obtained from white iron is to be properly considered a hydrated carbon; that is to say, whether we are to consider the H_2O as united to the carbon in the same way as it is to metallic oxides to form what are known as hydrated oxides. If, however, it is to be considered as combined in a manner analogous to the H_2O, with ethyl to form alcohol, then there may be some plausibility in the hypothesis. For it will be remarked in referring to the actions of this hydrated carbon that it in no way resembles amorphous or ordinary carbon.

It is represented by MM. Schutzenberger and Bourgeois as follows:—$C_{11}:3H_2O$; carbon, 70·95; hydrogen, 3·23; oxygen, 25·80 per cent.

According to M. Cloez the carbonaceous matter of the Orgueil meteorite, after being dried at 110°, was found to be composed of:—Carbon, 63·45; hydrogen, 5·98; oxygen, 30·75; and when we consider that some of this hydrogen belongs to the hydrocarbon now known to exist in that meteorite, the remainder of the hydrogen will approach near the proportion required to form water with the oxygen; and the quantity of carbon that may exist as a hydrate will be slightly diminished.

Attempts were made to separate completely all the mineral matter from the carbon, but I have failed to do so, after using fluorhydric acid alone, and in conjunction with nitric acid, also fluoride of sodium and sulphuric acid with a small amount of water, then treating the residue with cold nitric acid. There is no difficulty in getting rid of a great part of it, but in every instance the carbonaceous matter has been altered, however carefully the temperature was managed.

When this matter thus obtained is heated in a closed tube, after being dried at 110° C., it not only furnishes water at about 250° C., but gives out a very strong odour somewhat like that produced from certain bituminous coals, at one point resembling the disagreeable odour of an ignited cigar of a very inferior quality of tobacco.*

Viewed in the light of these experimental researches, the most reasonable conclusion is that this carbonaceous matter is not in any proper sense either carbon or humus, but a carbon compound analogous to the one just referred to.

Future researches upon the solid compounds, resembling in appearance amorphous carbon, such as hydrographitic oxide, pyrographitic oxide, carbon hydrate, and similar compounds that may yet be discovered, will doubtless throw some light on the true nature of the carbonaceous compound of the black meteorites. So far as our knowledge now extends, its formation and its origin are wrapped in as much obscurity as the origin of the bodies in which it is found.

What we do know is that this carbonaceous matter occurs with the same minerals, viz., olivine and pyroxene, which are the predominating constituent materials of all stony meteorites; also with the nickeliferous iron found in both stony and metallic meteorites; and furthermore, that this carbonaceous matter contains curious crystalline products soluble in ether and sulphide of carbon, which last have been traced in the graphite nodules in the interior of the metallic meteorites. Moreover, in these graphite nodules we have found magnesia, which is so uniformly a constituent of the minerals of the stony meteorites.

So far then as our present knowledge goes, we know of celestial carbon in three conditions, viz.: in the *gaseous form* as detected by the spectroscope in the attenuated matter of comets; in meteorites in the *solid form*, impalpable in its nature and diffused in small quantities through pulverulent masses of mineral matter that come to the earth from celestial regions; also in the *solid form, but compact and hard*, resembling terrestrial graphite, and this is imbedded in metallic matter that comes from regions in space. But while we speak of these as forms of carbon, I think we should be careful in associating it in our minds with the element carbon as we understand it in its pure state whether crystallised or amorphous, for I cannot reconcile the carbon vapour detected in comets as simply that known as pure carbon in the form of an elastic vapour, nor are we to circumscribe ourselves with the notion that this cosmical carbon has an organic origin.

The researches embraced in this communication, while in many respects of a novel character, are imperfect from their very nature, both from lack of material for a thorough and complete study, as well as from the present imperfect methods of operating upon the minute quantity of the most interesting of the substances obtained.

I have therefore detailed as carefully as I could all the results as they have developed themselves, hoping that future opportunities may be afforded for continuing them, when new celestial messengers of the carbonaceous type shall visit our globe.

* This odour will be found to belong to the hydrated carbon from cast-iron, when heated in the same way.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, May 18th, 1876.

Professor Abel, F.R.S., President, in the Chair.

After the minutes of the previous meeting had been read and confirmed, and the names of the visitors announced, the following names were read for the first time:—Messrs. A. B. Cortis, G. F. Thomson, J. Heron, C. G. Matthews, G. Evans, J. R. Hakewell, and Dr. Otto N. Witt. Messrs. Joseph Davidson, D. Hesketh Richards, and W. J. Han-

ner were elected Fellows of the Society after their names had been read for the third time. Professors Baeyer, Butlerow, Cooke, Friedel, Heintz, and Thomsen were also elected Foreign Members.

The first paper, "*On the Action of Malt Extract on Starch*," was read by the author, Mr. C. O'Sullivan. After a short account of the literature bearing on this subject, the author gave details of his own experiments, from which it would appear that maltose and dextrin are the only products of the action of malt extract on starch, but there is no action in the cold on ungelatinised starch, the malt extract beginning to dissolve starch at the temperature of gelatinisation, or a few degrees lower. This temperature varies for the starches from different sources, and even for the different sized granules of the same starch. If, however, starch be previously gelatinised, malt extract dissolves it almost completely in the cold. When starch is dissolved by malt extract at any temperature below 63° C., if the solution be cooled and filtered after the lapse of five to ten minutes, it invariably contains maltose and dextrin in about the proportion of 67·85 of the former to 32·15 of the latter. At any temperature between 64° and 68° or 70° C. the product will be found to contain them in the proportion of 34·54 maltose to 65·46 of dextrin, whilst at 68° or 70° C. to the point at which the activity of the transforming agent is destroyed they will be in the proportion of about 17·4 maltose to 82·6 dextrin. These three reactions are respectively represented by the equations—

$$C_{18}H_{30}O_{15}+OH_2=C_{12}H_{22}O_{11}+\ C_6H_{10}O_3$$
$$2C_{18}H_{30}O_{15}+OH_2=C_{12}H_{22}O_{11}+\ 4C_6H_{10}O_3$$
$$\underbrace{4C_{18}H_{30}O_{15}}_{\text{Starch.}}+OH_2=\underbrace{C_{12}H_{22}O_{11}}_{\text{Maltose.}}+\underbrace{10C_6H_{10}O_3}_{\text{Dextrin.}}$$

The President thanked the author in the name of the Society, and said they were much indebted to him for the account of these important and interesting reactions.

Prof. Church desired to express his great satisfaction at Mr. O'Sullivan's paper, as he had occasion to examine the same subject himself. From the difficulty there was in dissolving a portion of the starch, he was inclined to agree with the view that it consisted of two bodies—starch granulose and starch cellulose—the latter, of which there was only 4 to 5 per cent, being difficultly soluble. Pure cellulose from cotton-wool dissolves readily in dilute sulphuric acid of a certain strength, and if the solution is at once poured into water the cellulose is precipitated: if the acid solution be allowed to stand some time, however, no precipitate is produced on pouring it into water.

A Member said he had made some experiments on the transformation of starch by sulphuric acid, and had found that the amount of water present had an important effect on the conversion. He might also mention a way by which the difficulty of drying syrupy substances might be obviated, and that was by placing them on a tared piece of filter-paper: when heated the substance melted, soaked into the paper, and dried readily.

Mr. O'Sullivan, in reply, said, with regard to the observations made by Prof. Church, the difference observed in the action on starch was not due to the presence of two principles, but to the fact that in the same starch the small granules were far less soluble than the larger ones. In the conversion of starch into dextrose by sulphuric acid he had observed that before all of it was converted other neutral substances were formed. He had been working on this subject, and hoped to lay an account of his experiments before the Society ere long. He stated there was no difficulty in drying the extracts: they were evaporated to a syrup, then put under the receiver of an air-pump over sulphuric acid. On exhausting they swelled up, and soon dried up completely.

Dr. H. E. Armstrong then read a paper "*On 'Meta-xenol,'*" by himself and Mr. Gaskell. After alluding to Fittig's and to Wurtz's researches, who had obtained xenols from mesitylene and from coal-tar xylene, the one liquid and the other solid, the speaker said they had prepared xenol from carefully rectified coal-tar xylene, boiling at 136° C., by fusing the potassium sulphonate with potassium hydrate. The xenol obtained, which became a pasty crystalline mass at a low temperature, was converted into the sulphonic acids by treatment with sulphuric acid, and the barium salts prepared. In this way two salts were isolated, one of which crystallised with 3 molecules of water; the corresponding potassium salt when heated with hydrochloric acid in sealed tubes yielded a solid meta-xenol, identical with that obtained by Wurtz, and melting at 76° C.; the other, a basic salt which only contained 2 molecules of water, gave a liquid xenol when similarly treated. The action of bromine on the meta-xenol sulphonic acid gave rise, in the first place, to a monobrominated acid, $C_6HBr(CH_3)_2(HSO_3).OH$, which by the further action of bromine was converted into dibromoxenol, $C_6HBr_2(CH_3)_2.OH$, melting at 80°. The latter compound was also obtained on treating xenol with bromine. On adding bromine to xenol and water, however, in the manner practised by Fittig, a mixture of two substances was obtained, which, when crystallised from alcohol, gave yellow crystals melting at 176° C., and supposed by Fittig to be dibromoxenol: the yellow substance appears, however, to be formed by the action of the alcohol on a bromine addition-product. The authors have also obtained a crystalline dinitro-derivative by the action of nitric acid on the sulphonic acid.

The President having thanked the authors,

Mr. J. W. Thomas read a paper "*On the Gases Enclosed in Cannel Coals and in Jet.*" The author has examined the gases obtained from two specimens of Wigan cannel, two of Scotch cannel, namely, Haywood and Leshmahago, Whitehill cannel shale, and the finest quality of Whitby jet, such as is used for ornaments, the processes employed being similar to those described in his former paper on anthracite, bituminous, and steam coals. He finds that the cannel coals as well as jet differ considerably from these, containing methane, ethane, and probably other gaseous paraffins, as well as oily matters which likewise appear to belong to the same series. Wigan cannels, with regard to the gases they contain, occupy a position intermediate between steam and Scotch cannel, whilst Scotch cannel occupies a position between bituminous house coals and Wigan cannel.

The fourth paper, "*On Phenomena Accompanying the Electrolysis of Water with Oxidisable Electrodes*, by Dr. J. H. Gladstone and Mr. A. Tribe, was read by the former. The authors have employed electrodes consisting of narrow plates of zinc, lead, iron, copper, silver, and platinum, together with the purest water collected directly from the pipe of the still, using a single cell of Grove for each pair of electrodes. The result obtained with platinum was negative, but in the case of the more active metals no oxygen was given off at the positive electrode as gas, but it combined with the metal, forming a hydrate, and as the hydrates are probably more or less soluble in water, a dilute solution of the metallic compound is soon formed, which is successively decomposed, the final result being the deposition of metal on the negative electrode, as a growth of threads, fringes, or arborescent crystals. The comparative solubility of the metallic hydrates in water has doubtless a great effect on the ultimate result, but the differences observed with the various metals must be looked for in their different electromotive force or affinity for oxygen.

The last paper "*On the Estimation of Hydrogen Occluded by Copper, with special reference to Organic Analysis*," by Dr. J. L. W. Thudichum and Dr. H. W. Hake, was read by the latter. From the results of their experiments the authors are inclined to differ from Mr. Johnson—who some time since published a note on this subject—and believe that no error of importance is introduced by the hydrogen occluded by copper which has been allowed to cool in an atmosphere of that gas, especially if the copper employed has been previously used in analysis. The amount of gas evolved under ordinary circumstances

would not introduce a greater error than 0·025 of a per cent, and even this may be avoided by allowing the copper—after it has been reduced by hydrogen—to cool in a current of carbonic anhydride.

The President, in thanking the authors, said the Fellows, especially those engaged in organic analyses, were much indebted to them for pointing out the smallness of the error likely to accrue from the occlusion of hydrogen by copper, and also for pointing out a very simple way by which it might be avoided.

The meeting was then adjourned until Thursday June 1, when the following papers will be read:—"On Hemine, Hematine, and Phosphorised Compounds contained in Blood Corpuscles," by J. L. W. Thudichum and H. Kingzett; also "Note on the General Applicability of Frankland and Armstrong's Combustion Method to the Estimation of Carbon and Nitrogen in Carbon Compounds," by the same authors; "On the Liquid Carbon Dioxide from Different Sources," by W. N. Hartley; "(1) On Peroxides, (2) On the Estimation of Nitrogen, (3) On Chromic and Perchromic Acids, by T. Fairley; "On Aluminium Nitride," by Prof. Mallet; and "Chemical Studies," by Prof. Dewar.

NOTICES OF BOOKS.

Quantitative Chemical Analysis. By Dr. C. Remigius Fresenius. Seventh Edition. Translated from the Sixth German Edition by A. Vacher. Vol. I. London: J. and A. Churchill.

The re-issue of a work whose merits are fully and universally admitted affords, as a rule, little scope for the reviewer. The present case, however, forms an exception. Like other departments of chemistry the art of analysis has made considerable progress during the last ten years, and an entire revision of every part of the work has hence become necessary. New methods have been introduced, and those formerly in use have been subjected to a minute and scrupulous verification and modified in accordance, or their imperfections, and the condition under which they cease to be trustworthy, have been pointed out. The work has also been enlarged. The first volume, now before us, contains the general part of the subject. The second volume, announced as shortly to appear, comprises the application of the rules and principles laid down in the former part to especial cases, including technological products and mixtures. This section in the earlier editions constituted a mere appendix.

The following passage from the author's introduction bears so pointedly upon a question frequently discussed in our columns, expresses our views with such power and authority, that we do not hesitate to quote it in full:—

"Everyone who has been engaged in quantitative analysis knows that cases will sometimes occur, especially when commencing the study, in which doubts may be entertained whether the result will turn out correct, or in which the operator is even positively convinced that it cannot be quite correct. Thus, for instance, a small quantity of the substance may be spilled, or some of it lost by decrepitation, or the analyst may have reason to doubt the accuracy of his weighing, or it may happen that two analyses of the same substance do not exactly agree. In all such cases it is indispensable that the operator should be conscientious enough to repeat the whole process over again. He who is not possessed of this self-command, who shirks trouble where truth is at stake, who would be satisfied with mere assumptions and guess-work where the attainment of positive certainty is the object, must be pronounced just as deficient in the necessary qualifications for quantitative analytical research as he who is wanting in knowledge or skill. He, therefore, who cannot fully trust his work, who cannot swear to the correctness of his results, ought, on no account, to publish or use his results as if they were positive, since such proceeding could not conduce to his own advantage, and would certainly be mischievous as regards the science."

But what, then, of the "high" and the "low" commercial analyst who is quite ready to use, publish, and swear to his results, not merely where doubtful, but when he well knows them to be erroneous; and what must be the influence of such conduct on science, and on the chemical profession? Can competent and upright men afford to permit this system to continue?

The section on the determination of phosphoric acid and its separation from bases is exceedingly elaborate. A careful comparison of the precautions here indicated, with the procedures adopted by certain agricultural analysts, will make the conflicting results so frequently obtained perfectly intelligible. The old "commercial process" so-called, precipitation with ammonia as a salt of lime, is very justifiably ignored. The only method pronounced applicable for the separation of phosphoric acid from all bases is Sonnenschein's molybdate of ammonia process, and the precautions to be taken are fully explained. The magnesia process—precipitation with so-called magnesia-mixture—is not recommended in presence of alumina. Ville's modification of the process as described in the Chemical News (vol. xxx., p. 200) is not critised. Of Chancel's bismuth method it is remarked, quite correctly, that it "cannot lay claim either to quickness or accuracy." The volumetric process with uranium solution is declared inapplicable in presence of sesquioxide of iron and alumina. If these bases have to be previously removed its great advantage, speed, is materially reduced.

For the determination of copper the methods of Steinbeck and Luckow are recommended. The difference between this edition and the abridgment translated from the fifth German edition and published in 1870, cannot be better explained than by a reference to the section on sulphuric acid. If any tyro who has determined this acid with no other precautions than those laid down on page 165 of the earlier edition, comes to read the paragraph on page 299 of the one before us he will doubtless be led to regard his results with some misgivings. In the presence of salts of iron we have found the precaution of adding a little tartaric or citric acid—first recommended, we believe, by Prof. T. E. Thorpe, of the Yorkshire College of Science—very useful in preventing the sulphate of baryta from being contaminated with traces of iron.

The translator has executed his task in a thorough and conscientious manner. There is no attempt at abridgment—a process fatal to a work of this kind where the author has introduced nothing but what his experience has pointed out as absolutely necessary. The old notation and nomenclature are retained by the express wish of the author, who declares that he holds, in common with the highest authorities in Germany, "a most firm conviction that for Inorganic Chemistry it is the simplest and the best." We cannot help respectfully commending this passage to the notice of critics who denounce an author for having used the term "phosphate of soda" instead of the lengthier and perhaps more high-souding "hydrodisodic phosphate." The index—a matter of great importance in a book intended for constant reference—is very elaborate. It is scarcely necessary to add that no analytical chemist can afford to be without a copy of this new edition of the masterpiece of Dr. Fresenius.

Railway Appliances: a Description of Details of Railway Construction. By John Wolfe Barry. London: Longmans, Green, and Co.

This book belongs to a series entitled "Text-Books of Science Adapted for the Use of Artizans and Students in Public and Science Schools." Now without any wish to call in question its utility, or the accuracy of the information it conveys, we feel considerably puzzled to know why it should be considered a "Text-Book of Science." Its

object is not to explain phenomena by reducing them under laws, but to give rules for attaining certain ends. Hence all sound methodologists would term it a text-book, not of science, but of art.

The first chapter of the work gives a summary of acts of Parliament and other regulations affecting railways. Upon this follow in succession chapters on the permanent way, on points and crossings; on signals, on the block system, on stations, and on rolling-stock. The important subject of signals, we may here remark, is receiving at present an increased amount of attention, in part probably owing to the lamentable Huntingdon collison. The fact that a sudden and violent snow-storm, which, after all, is a possible occurrence at any time during the five or six months of the year, may at any time cause the signal for "danger" or for "caution" to be interpreted as "safety" and allure a train to the destruction of its inmates. Nor is this all; red or green lights produced by the interposition of coloured glasses between a lamp and the eye of an observer are exceedingly reduced in their illuminating power. Hence the question arises whether colour should not be altogether discarded, and whether the number and the position of the lights exhibited might not be made available. Thus a single light might express safety, two in a perpendicular line denoting caution, and three standing for danger.

The author seems somewhat sore on the subject of danger on railways. He "regards as a popular error the supposition which is from time to time advanced that railway engineers and managers are, as a body, remiss in attention to the safety or convenience of the public. From personal experience he can vouch for the care, foresight, and anxiety which are bestowed on these subjects by those in charge of our railways." We are delighted to hear it, and hope that some day all this "care, foresight, and anxiety" will begin to bear a little fruit.

This work, to the best of our knowledge, takes up ground previously unoccupied, and we have no doubt that it will be found highly useful by such as are likely to be engaged in the construction or management of railways.

CORRESPONDENCE.

THE CHEMICAL SOCIETY.

To the Editor of the Chemical News.

SIR,—One would properly expect, from its very name, that the Chemical Society was an association of chemists for the advancement of chemistry, and it would be natural to think that its Fellows were chemists.

Need I say, Sir, that such is not at present the case with the Chemical Society of London. By the indiscriminating admission in times past of all candidates, it has at last reduced itself to its present state—not a body of chemists, but a motley mixture of all kinds of dabblers in science, and often, alas! very often, not even that. It was only to be expected, and the present relations of the Society to the profession too plainly show it to have been so, that it would soon alienate from itself all real chemists, and cease to represent the chemistry of this country.

Recently awakened to the fact that their Society was in disgrace and was begun to be held in derision, and almost in contempt, even by themselves, a number of the Fellows have for some time past steadily refused to admit any but those who show unmistakable evidence of chemical attainments, and so at each successive meeting a larger and larger proportion have been blackballed, until, last meeting but one, two-thirds of the candidates were rejected.

It appeared as if, at last, there were some hope of the Chemical Society making its Fellowship worth the having—it appeared likely to regain its chemical prestige and attract to itself many who now hold aloof. But, for some reason, this course has not recommended itself to the senior Fellows, and at the last meeting, on the 18th inst., the President, speaking on their behalf, strongly advised that the practice should be discontinued.

Many of those who, like myself, heard that speech must have been deeply pained to hear from the President of the Chemical Society, and that President Prof. Abel, that a "strictly chemical qualification" ought not to be required for its Fellowship.

No doubt Prof. Abel, like ourselves, has the prosperity of the Chemical Society at heart, but while he seeks it in large numbers without much regard to quality, we see its best interest in a high standard of fellowship, by which the dignity of the Society may be so raised that many would be drawn into it who now hold back in disdain. Upon this point, whether the numbers of the Society will be lessened, the opposition turns, and as there does not appear any reason to fear falling off in this respect, it is to be hoped they will adopt the view that the attractiveness off the Society will increase with the standard of qualification required, and heartily join the movement.

It has been admitted by all, even by Prof. Abel and his colleagues, that something must be done to raise the chemical profession out of its present deplorable condition. It must be organised; either the Chemical Society must be made a society of chemists indeed, or some new body, representing the profession, must be founded, such as the "Institute of Professional Chemists" now under consideration. Then I, for one, will not care who is admitted to the Chemical Society, but until then, and so long as the F.C.S. is considered to indicate chemical abilities, so long must the gates of the Chemical Society be closely guarded.

"Sculptor," "Artist," "Clerk in Holy Orders," "B.A.," "B.Sc."—vaguest of all—"Science Teacher;" these, forsooth, are the qualifications stated by candidates on their papers. What must they think of the Chemical Society! What must be their respect for it!

In conclusion, I sincerely hope that the Fellows will continue to exercise more and more care in electing candidates, and they may then hope to have a society commanding the respect of chemists.—I am, &c.,

NUNTIUS.

BLACKBALLING AT THE CHEMICAL SOCIETY.

To the Editor of the Chemical News.

SIR,—On the 4th instant, six out of nine candidates for admission to the Chemical Society were rejected by its Fellows. On the 18th (the last meeting of the Society) the President condemned this act in language which, to say the least, was injudicious, and which most certainly would have been received in a different spirit had it not been for the great respect entertained for the speaker. In brief, it was intimated that the Fellows ought not to use their individual judgment, and that the blackballing was indiscriminate. If this latter be true, it is a grievous fault and calls for immediate rectification. I take it that the qualification required for the Fellowship of the Chemical Society is a chemical one, and a chemical one only. If candidates fail to state this briefly, clearly, and truthfully they, and they alone, are responsible for their non-election. A sculptor or artist may justly aspire to the membership of the Royal Academy; an M.D. to the membership of one or more of the Medical Societies; and a D.Sc. to the membership of a Society for the Propagation of General Knowledge. But as these are not chemical qualifications, the man who offers these and these alone insults the Chemical Society, and should, in consequence, be unanimously rejected. Had the President sought for the real cause of the independent action of which he complained, he would have found it in the profound distrust which the majority of the working Fellows of the Society have for those who should be their profes-

sional leaders, men who, with few exceptions, seldom attend their meetings, and yet, being leaders of their Society, systematically sacrifice the British chemist and British chemistry, simply to increase the number of Fellows, and thus give to the Society of which they are the nominal heads a fictitious importance.—I am, &c.,

TWIG.

May, 22, 1876.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances, de l'Academie des Sciences. No. 18, May 1, 1876.

Electromotor Forces Produced by the Contact of Liquids Separated by Capillary Diaphragms of any nature whatsoever.—M. Becquerel.—Solutions, or the bodies which they contain, are condensed in capillary spaces in the same manner as are gases in porous bodies.

Microscopic Examination of Orthose and of various Triclinic Felspars.—M. Des Cloiseaux.—This interesting paper is not capable of abstraction.

Electric Polarisation.—M. Th. du Moncel.—Not suitable for abstraction.

New Researches on Gallium.—M. Lecoq de Boisbaudran.—Inserted in full.

Experiments on Solar Heat.—M. Salicis.—The author's experiments have given the interesting result that if the evaporation is slow in a glass boiler exposed to the sun's rays, which might be expected, it becomes very active if a metallic nucleus is fixed in its centre, such as a phial of mercury, thus procuring in the midst of the water a furnace exhaustless as the sun. A second result is that if an oxidisable metal is used as a nucleus, such as iron, the production of iron is very rapid, and, consequently, also the production of hydrogen.

Phenomena of Interference obtained with Slender Laminæ of Collodion.—M. E. Gripon.—Not suitable for abstraction.

Distribution of Magnetism in Cylindrical Bars.—M. Bouty.—This paper consists chiefly of mathematical formulæ.

Transmission of Electric Currents by Derivation across a River.—M. Bouchotte.—An account of an experiment on the transmission of telegraphic signals through water without wires.

New System of Electro-Magnet.—M. V. Serrin.—The author forms his electro-magnetic spirals with metallic coils deprived of all insulating coatings, and arranged so that the coils may not touch each other.

New Sulphate of Potassa.—M. J. Ogier.—The composition of this salt is—

Sulphuric acid (SO_3)	44·9
Potassa (KO)	50·6
Water (HO)	4·6
	100·1

The formula $SO_3KO + \frac{1}{2}HO$ would require—

Sulphuric acid	43·7
Potassa	51·3
Water	5·0
	100·0

The peculiarity of its properties seems due to a very small quantity of benzino-sulphate of potassa.

Origin of Fibre in Puddled Iron.—M. H. le Chatellier.—The grain or absence of fibre is generally produced by the fusibility of the manganiferous or alkaline scoriæ by the softness of carburetted or phosphuretted iron when heated, and by the high temperature at which the puddling is conducted: the fibre, on the other hand, results from the sparing fusibility of partially peroxidised scoriæ, and from the comparatively low temperature of the puddling.

New Crystalline Organic Compound.—M. D. Loiseau.—The newly discovered body has received the name of raffinose. Its elementary composition is—

Carbon	36·30
Hydrogen	7·07
Oxygen	56·63
	100·00

corresponding to the formula $C_6H_7O_7$, or to one of its multiples. It is almost devoid of sweetness; its rotatory power when dissolved in water is greater than that of sugar.

Crystalline System of Several Substances presenting Optical Anomalies.—M. E. Mallard.—The crystalline bodies in question are amphigene, analcime, boracite, senarmontite, and apophyllite.

Bulletin de la Société d'Encouragement pour l'Industrie Nationale, No. 29, May, 1876.

This issue contains no chemical matter.

Moniteur Scientifique, du Dr. Quesneville, April, 1876.

Review of Physics.—M. R. Radau.—This includes a paper on the phenomena produced by the concourse of two sounds; a notice on a "diapason with variable sound;" a paper on the abnormal dispersion of light; and one on the relations between light and electricity.

Progress of the Manufacture of Artificial Colouring Matters.—M. A. Wurtz.—This memoir, taken from the fifth volume of the Official Report of the French Comission at the Vienna Exhibition, gives an account of the preparation of rosanilin and its congeners, of the manufacture of nitrobenzine and aniline, of nitrotoluens and toluydins, of violanilin and Coupier's blue, of soluble blues, &c.

Pathological Chemistry.—M. A. Commaille.—A medico-chemical paper on suppurating pancreatitis, on jaundice from retention of bile, and on diabetes mellitus. The author gives instructions for the analysis of the tissues and secretions.

Black Inks.—M. E. H. Viedt.—A very long memoir, giving a full account of the manufacture of black inks.

Manufacture of Extract of Indigo.—M. Max Rœsler.—An interesting paper, too long for insertion? The author dissolves the indigo in a mixture of 9 parts fuming sulphuric acid to 2 of the common monohydrated acid. He takes 500 grms. of dry powdered indigo to 2¾ kilos. of mixed acid, and he adds the acid by two equal successive portions to the indigo.

History of the Manufacture of Turkey-Red.—Theodore Chateau.—A continuation.

Report on the Process of Faure and Kessler for he Manufactute of Sulphuric Acid.—Already noticed.

MISCELLANEOUS.

The Loan Collection at South Kensington.—The conferences in connection with the Loan Collection of Scientific Apparatus at South Kensington have been highly successful. In an early number we shall give abstracts of the papers contributed to the Chemical Section, which was opened on Thursday, the 18th inst., by

an address from the President, Dr. Frankland, F.R.S., Dr. J. H. Gilbert delivered an address on "Some Points Connected with Vegetation;" Mr. W. F. Donkin described Sir Benjamin Brodie's ozone apparatus; and Prof. Andrews gave an account of his investigations on the physical constitution of gases. The second and final meeting of the Section was on Tuesday last, when Dr. Frankland read an important communication from M. Frémy on the Diminution of Scientific Research. Addresses were also delivered by Prof. Roscoe, "On Vanadium and its Compounds;" by Prof. Guthrie, "On Cryohydrates and Water of Crystallisation;" by Prof. Williamson, "On the Manufacture of Steel;" by Mr. W. C. Roberts, "On the Apparatus used by the late Prof. Graham in his Researches;" by Mr. W. N. Hartley, "On Liquid Carbonic Acid in the Cavities of Crystals;" and by Prof. Gladstone, "On the Electrolysis of Organic Compounds with the Copper-Zinc Couple."

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

Improvements in the production of ammonia. A. M. Clark, Chancery Lane, Middlesex. (A communication from F. Maxwell-Lyte, Paris.) February 16, 1875.—No. 563. The invention consists in the special reaction of nascent hydrogen produced in presence of a triad or pentad element and nitrogen for the production of ammonia by synthesis of its elements.

Improvements in filters and percolators. W. B. Gething, Fleet Street, London. February 16, 1875.—No. 566. I form the body of the filter or percolator in the form of an inverted cone, into the bottom of which I insert or place a piece of perforated metal or other material to act as a strainer to the said filter or percolator. I place a metal cover with screw-cap inserted, and at the bottom of the said filter I put a funnel, so that it can be put into a bottle or other narrow mouthed vessel. The said filter or percolator may be made of tinned iron or other metal, and japanned or otherwise ornamented to protect it from damage or corrosion. The advantages I claim are that it (the filter) will always keep the liquor free from dust or dirt or evaporation while in process of filtration.

Improvements in the method or means employed in treating and clarifying sewage or other impure waters. S. Hadsworth, Armley, and R. Banes, Woodhouse Carr, both near Leeds, York. February 17, 1875.—No. 573. First mixture—Copperas, dry copperas, copperas bottoms, copperas sediment, the sediment that subsides from manufacture of nitrate of iron, the spent residue of iron pyrites, also spent pyrites. Second mixture—Spent residue of iron pyrites, iron ore or slag saturated with liquor from beds of iron pyrites at copperas works, or with diluted sulphuric, or muriatic, or diluted nitric acid. The sewage or other matter is run into tank, to which is added slacked lime or gas-lime, clarifying mixture No. 1, or mixture No. 2; the whole is agitated, allowed to settle, and the pure water run off.

An improved process and apparatus for treating vegetable substances for the extraction of fatty matter, and for the manufacture of spirits and fermented liquids. A. Manbré, Baker Street, Portman Square, Middlesex. February 17, 1875.—No. 579. My improved process is for extracting the fatty matter contained in fruits, cereals, seeds, nuts, roots, and other vegetable substances containing fatty, starchy, or saccharine matters, thereby freeing the starchy and saccharine matters from the fatty matter, and rendering them more suitable for the production of purer and better flavoured spirit and wine, beer, and other fermented beverages.

Improvements in the manufacture of steel. J. Noad, Richmond House, Plaistow, Essex. February 18, 1875.—No. 592. This Provisional Specification describes taking iron or steel obtained by a process of chemical deposition, and placing a small quantity of such iron or steel in a crucible, and pouring upon it cast-iron or other metal melted in a cupola furnace, so as to fill the crucible. The crucible is then closely covered, and the metal is maintained at a high temperature for some time, and then cast into ingots.

A new process for bronzing or giving a metallic appearance to textile fabrics. W. Thackrah, Dewsbury, York. February 19, 1875.—No. 608. The novelty of the invention consists in producing upon piled fabrics, which have been previously dyed, a bronzed or metallic appearance by chemical agency, viz., subjecting such fabrics to various baths composed of tannic acid, picric acid, and then a solution of nitrate of tin and muriate of copper. Finally, the fabrics are boiled in a solution of aniline.

Improvements in the manufacture of colouring matter suitable for dyeing and printing. A. Kotigen, Old Broad Street, London. (A communication from A. Gauhe, Barmen Eitorf, Rhenish Prussia.) February 20, 1875.—No. 619. The process consists in heating the substance known to chemists under the name of anthracen with concentrated or fuming sulphuric acid to a temperature from between 240° to 260° C. until, in diluting a small portion of it with water, no more precipitate is produced. The anthracen used should be as pure as possible, because the purer the anthracen the less sulphuric acid is required for its perfect solution. The quantity of sulphuric acid varies if the ordinary concentrated acid is used, from between 10 to 20 parts of the weight of anthracen used, if fuming acid be employed, from between 3 to 10 parts of the weight of anthracen. The resulting liquid has to be dissolved in about fifteen to twenty times of its volume of water and neutralised with caustic lime or carbonate of lime. After filtration, the liquid, which contains now the lime salts of what I call the sulpho-acids of anthracen, is precipitated with carbonate of soda. The soda salts of the above sulpho-acids received in this way are heated with two to three times their weight of caustic soda or potash, or a mixture of both, in a suitable vessel to a temperature from between 180° to 200° C. until, in dissolving a portion of the fused mass in boiling water, the colour ceases to become more intense. The fused mass is then dissolved in boiling water, and precipitated with hydrochloric, or sulphuric, or any other convenient acid. The precipitate is collected on a filter, washed with water, and is then suitable for use in dyeing and printing, in the same manner as preparations of madder.

Improvements in filtering and purifying water. O. V. Morgan, Kensington, Middlesex, and G. R. Moelchaerek, Battersea, Surrey. February 20, 1875.—No. 625. This invention consists in the special use of calcium carbonate in addition to or in combination with other filtering media, either as forming part of the filter or in the form of cups or vessels to be used in conjunction with filters of any description, or by themselves, more particularly for the purpose of removing lead from its solution in water to be filtered.

MEETINGS FOR THE WEEK.

SATURDAY, 27th.—Physical, 3. "On Selective Absorption," by W. Ackroyd. "On an Atmospheric Phenomenon in Ceylon," by Rev. R. Abbay.

TUESDAY, 30th.—Society of Arts, 8. (African Section). "The Development of Central Africa," by Edward Hutchinson.

—— Royal Institution, 3. "Wheatstone's Discoveries," by Prof. W. G. Adams.

THURSDAY, June 1st.—Royal Institution, 3. "On Voltaic Electricity," by Prof. Tyndall, D.C.L., LL.D., F.R.S.

—— Royal, 4. Election of Officers.

—— Royal, 8.30.

—— Royal Society Club, 6.30.

—— Chemical, 8. "On Hematine and Phosphorised Compounds contained in Blood Corpuscles," by Dr. Thudichum and Mr. Kingzett. "On the Liquid Carbon Dioxide in Different Species," by W. N. Hartley. "Notes on the General Applicability of Frankland and Armstrong's Combustion Method to the Estimation of Carbon and Nitrogen in Organic Compounds," by Dr. Thudichum and Mr. Kingzett. "(I.) On Peroxides; (II.) On the Estimation of Nitrogen; (III.) On Chromic and Perchromic Acids," by Thomas Fairley. "On Aluminium Nitride," by Prof. Mallet. "Chemical Studies," by Prof. Dewar. "On the Volumetric Estimation of Mercury," by Prof. Tuson and Mr. Neison.

FRIDAY, 2nd.—Royal Institution, 9. "Recent Discoveries about Vanadium," by Prof. Roscoe.

—— Geologist's Association, 8.

SATURDAY, 3rd.—Royal Institution, 3. "On King Arthur's Place in English Literature," by Prof. Morley.

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AIR AND ITS RELATIONS TO LIFE, the substance of a Course of Lectures delivered at the Royal Institution of Great Britain in 1874, with some Additions. By WALTER NOEL HARTLEY, F.C.S., Demonstrator of Chemistry at King's College, London. Second Edition, revised.

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UNIVERSITY OF LONDON.

Notice is hereby given, that the next Half-Yearly Examination for MATRICULATION in this University will commence on MONDAY, the 26th of JUNE, 1876. In addition to the Metropolitan Examination, Provincial Examinations will be held at St. Cuthbert's College, Ushaw; Stonyhurst College; St. Stanislaus College, Tullamore; Owens College, Manchester; Queen's College, Liverpool; and Queen's College, Birmingham.

Every Candidate is required to transmit his Certificate of Age to the Registrar (University of London, Burlington Gardens, London, W.) at least fourteen days before the commencement of the Examination.

WILLIAM B. CARPENTER, M.D.,
Registrar.

May 22nd, 1876.

THE CHEMICAL NEWS.

Vol. XXXII. No. 862.

ON THE CLASSIFICATION OF THE CYANOGEN COMPOUNDS.

By SYDNEY LUPTON, M.A.

In a suggestive paper published in the Chemical News (vol. xxxiii., p. 141) Mr. Skey calls attention to the present state of our knowledge of the relationships of cyanogen, and draws the conclusion that it is far more nearly similar in its properties to oxygen than it is to chlorine. It may be of value to attempt to classify a few of the more important cyanides and then to examine the arguments brought forward by Mr. Skey.

From the intimate connection between the various members of the cyanogen group, they are, in general, considered together as a separate section of organic chemistry.

In a general review of these bodies the first thing which strikes us is the large number of compounds in which CN plays the part of a simple monatomic element; the second is the numerous complicated compounds containing the group CN more than once. Considering, then, the cyanogen compounds as a group to themselves, it is evidently of advantage to use as our means of classification the groups CN, and not, as is usually the case, the various bodies with which it may happen to be combined; just as the paraffins, for example, are classified by the number of atoms of carbon which they contain. Our next step is to enquire into the constitution and combining powers of the group CN on which our classification is to be based.

Carbon is in almost all its compounds a tetrad, *e.g.*, CH_4, CCl_4, &c.; it is, however, sometimes a dyad CO. Again, carbon may saturate some of its affinities by combining with itself C_2H_5Cl, C_2H_4, &c.

Nitrogen in many of its combinations plays the part of a pentad NH_4Cl, $NH_2(CH_3)'HBr$, &c., in others it acts as a triad $NH_3N(CH_3)'_3$, &c.; in one of its combinations, NO, it is apparently a dyad, and in another, NOH, a monad. Like carbon it possesses considerable power of self-saturation. From the more general valencies of carbon and nitrogen we should expect cyanogen to be tetradic carbon combined with either pentadic or triadic nitrogen. There was considerable doubt as to which of these formulæ belonged to cyanogen until Dr. Hofmann's brilliant discovery of the iso-cyanides, bodies clearly belonging to the former class. They are formed by distilling a mixture of an alcoholic ammonia base and chloroform with alcoholic potash—

$$C_6H_7N + CHCl_3 = 3HCl + C_6H_5.N.C.$$

The iso-cyanides are scarcely acted on by alkalies, but break up under the action of acids into formic acid and an alcoholic ammonia—

$$C_6H_5NC + 2H_2O = C_6H_5NH_2 + H_2CO_2.$$

Under similar conditions ordinary phenyl-cyanide breaks up into prussic acid and phenyl-chloride—

$$CNC_6H_5 + HCl = C_6H_5Cl + CNH.$$

Further confirmation of this view that cyanogen consists of tetradic carbon and triadic nitrogen is afforded by M. Gaultier's and Gal's discovery of the hydro-chlorates, hydro-bromates, and hydriodates of the cyanides and cyanates. In these bodies evidently the two atomicities of nitrogen previously saturated by one another are now saturated by hydrogen and chlorine, &c., just as we have ammonia and its congeners forming the ammonium salts. In the great majority of the cyanogen compounds we may leave out of consideration the fact that nitrogen is a pentad, and regard it simply as a triad in combination with the tetrad carbon. We thus see how in so many of ist compounds cyanogen acts as a monad exactly analogous to chlorine.

But further, just as we find nitrogen combining with itself in the oxides of nitrogen and in the azo-phenyl compounds; and as we find carbon combining with itself to form the connecting link of an organic body, so we may consider that cyanogen combines with itself to give us the more complicated cyanides; and as the addition of each atom of carbon makes an addition of two to the saturation-power of a molecule, so the addition of each group CN causes the addition of one to the saturation-power of the molecule.

It is of course possible that the addition of the cyanogen groups takes place by the combination of the two self-saturated atomicities of nitrogen, and this may account for certain instances of isomerism, *e.g.*, paracyanogen; but this point we have at present no means of deciding.

Leaving out of consideration the iso cyanides as not strictly belonging to the cyanogen group, we may arrange the cyanogen compounds into different classes as they contain once, twice, three times, &c., the group $CN' = Cy'$; thus we have:—

$$(Cy_1)'(Cy_2)''(Cy_3)'''(Cy_4)'''', \text{ &c.}$$

By this of course we entirely throw over the system of types, and classify by valencies which are in reality at the root of that system. What is the so-called water type but two monad groups each united to one dyad group, and so on for the other types? It must be admitted that in several cases this method of classification places divisions where perhaps there ought to be none, *e.g.*, between melamine and melam, and between potassium cyanide and zinc cyanide; but I venture to hope that it is at least no worse in this respect than any other system of classification which has been proposed.

Many of the cyanogen compounds are so difficult to examine that the difficulty of the classification consists as yet in their true empirical formula, and this can only be overcome by a very extended series of accurate analyses, *e.g.*, the nitroprussides. We know of cyanogen compounds which contain the group CN from 1 to 18 times, but many of the intermediate groups are still wanting.

It may be of interest to arrange the more important cyanides under their respective classes, putting in but few of the cyanides of organic bodies, as they are, in general, simple and would cause useless repetition.

Monocyanides $(Cy_1)'$.

CyH, prusssic acid	$CyNH_2$, cyanamide
$CyCH_3$, methyl cyanide	CyOH, cyanic acid
CyAg, silver cyanide	CyOK, potassium cyanate
Cy K, potassium cyanide	$CyONH_4$, ammonium cyanate
$CyNH_4$, ammonium cyanide	$CyOC_2H_5$, ethyl cyanate
CyCy, cyanogen	CySH, sulphocyanic acid
CyCl, cyanogen chloride	CySK, potassium sulphocyanide
CyBr, cyanogen bromide	$CySNH_4$, ammonium sulphocyanide
CyI, cyanogen iodide	

The three chief groups contained in this class are the cyanides of monatomic radicals, the cyanates, and the sulphocyanates. Cyanogen itself being the means of classification ought possibly not to appear in this list, but it is put in for the sake of uniformity. The double cyanide and nitride of titanium presents many points of difficulty; it possibly belongs to this class, its formula being written $Cy[Ti^{iv}(TiN)_3']$, but further analyses are wanting to establish its formula conclusively.

Dicyanides $(Cy_2)''$.

$Cy_2Cl_2(?)$, cyanogen chloride	$Cy_2(OH)_2$, dicyanic acid
Cy_2KAg, silver and potassium cyanide	Cy_2Se, cyanogen selenide
Cy_2Cu, cupric cyanide	Cy_2S, cyanogen sulphide
Cy_2Cu_2, cuprous cyanide	Cy_2HSH, cyanogen sulphydrate

Cy_2Hg, mercuric cyanide
Cy_2Fe (?), ferrous cyanide
Cy_2Co, cobaltous cyanide
Cy_2Ni, nickelous cyanide
Cy_2KAu, potassio-aurous cyanide
$Cy_2(NH_2)_2$, dicyano-diamide
$Cy_2(NH_2)OH$, dicyanamic acid
$Cy_2H_2(SH)_2$ (?), cyanogen disulphydrate
$Cy_2.SH.S.SH$, persulphocyanic acid
Cy_2S_2Cu, cupric sulphocyanide
$Cy_2S_2Cu_2$, cuprous sulphocyanide

We are here met by one of the first difficulties of our classification. Should such a body as Cy_2Cu be placed here or in the first class, that is to say are the cyanogen groups directly connected together, or is each only connected with copper? It appears to me, looking at the ease with which the cyanogen groups coalesce, that the first case is probably the true one; but the point needs further investigation.

Recent determinations of the vapour density of liquid cyanogen chloride seem to point to the formula $CyCl$, but it is possibly a case of dissociation.

The dicyanic acid mentioned is of course not fulminic acid, but the true dicyanic acid discovered by Poensgen.

Cyanogen disulphydrate and persulphocyanic acid are very difficult bodies to classify. It seems possible that the two latent nitrogen affinities of the cyanogen may here come into play.

Tricyanides $(Cy_3)'''$.

Cy_3Cl_3, cyanuric chloride
Cy_3Cl_2H, chlorocyanic acid
$Cy_3(OH)_3$, cyanuric acid
$Cy_3O_3H_2K$, $Cy_3O_3HK_2$, hydrogen and potassium cyanurates
$Cy_3O_3Na_3$, sodium cyanurate
$Cy_3O_3H(NH_3.cu)_2.H_2O$, $Cy_3O_3H_2(NH_3.cu)$, hydrogen and cuprammonium cyanurates
$Cy_3SH.S_2$, pseudosulphocyanogen
Cy_3CH, cyanoform
Cy_3P, phosphorus cyanide
$Cy_3(NH_2)_3$, cyanuramide (melamine)
$Cy_3(NH_2)_2OH$, ammeline
$Cy_3(NH_2)(OH)_2$, melanurenic acid
$Cy_3(NH_2)(SH)_2$, sulphomelanurenic acid
$Cy_3(NH_2)_2Cl$, chloro-cyanamide

The most important groups belonging to this class are the cyanurates and the amidated bodies.

Some doubt has recently been thrown on the existence of the chlorocyanic acid of Wurtz. It seems very possible from the formula of normal silver cyanurate—

$$Cy_6O_6Ag_6.H_2O$$

that the true formula of cyanuric acid is $Cy_6O_6H_6$; but the evidence is yet hardly sufficient to warrant such a change. The notation cu is used for an equivalent of copper to simplify the formulæ. The formulæ of the amidated compounds are but slightly changed from those given by Kekulé.

Tetra-cyanides $(Cy_4)^{IV}$.

Cy_4ZnK_2, potassio-zinc cyanide
$Cy_4Cu_2K_2$, potassio-cuprous cyanide
Cy_4CoK_2, potassio-cobaltous cyanide
Cy_4AuK, potassio-auric cyanide
Cy_4PtH_2, hydrogen platinocyanide
Cy_4PtK_2, potassium platinocyanide
Cy_4PtCu, cupric platinocyanide
Cy_4PdK_2, potassium palladio-cyanide
Cy_4SPtK_2, potassio-platinous sulphocyanide
$Cy_4(NH_2)_2H_2$, hydrazulmin
$Cy_4(NH_2)H_2OH$, hydrazulmoxin
$Cy_4H_2(OH)_2$, azulmic acid

The azulmic acid mentioned is that of Pelouze and Richardson; it is either isomeric or identical with mycomelic acid. It seems more probable that mycomelic acid has the formula $Cy_8H_4(OH)_4.H_2O$.

Penta-cyanides $(Cy_5)^{V}$.

Cy_5Fe_2K, potassio-ferrous cyanide of Städeler.

Hexa-cyanides $(Cy_6)^{VI}$.

Cy_6PtBa, barium platinic cyanide
Cy_6RuK_2, potassio-ruthenic cyanide
$Cy_6Os_2K_2$, potassio-osmic cyanide
Cy_6IrK_2, potassio-iridic cyanide
Cy_6RhK_2, potassio-rhodic cyanide
$Cy_6S_6Pt_6K_2$, potassio-platinic sulphocyanide
$Cy_6O_6Ag_6H_2O$, silver cyanurate
$Cy_6O_6Pb_{33}H_2O$, lead cyanurate
$Cy_6Fe_2{}_3H_2O$, ferric cyanide
$Cy_6(NH_2)'_4(NH)''$ melam
$Cy_6(NH_2)_3(OH)_3$, ammelide
$Cy_6(N)'''(OH)_3$, cyameluric acid

Ferric cyanide is obtained according to Wyrouboff when potassium ferrocyanide is boiled with ammonium chloride.

Hepta-cyanides $(Cy_7)^{VII}$.

Wanting.

Octo-cyanides $(Cy_8)^{VIII}$.

$Cy_8Fe_2Fe.4H_2O$, magnetic cyanide of iron of Pelouze
$Cy_8Cu_2K_6$, β potassio-cuprous cyanide
$Cy_8(NH_2)_2O_2(OH)_2.H_2O$, azoulmoxin.

Ennea-cyanides $(Cy_9)^{IX}$.

$Cy_9N(NH)_3$, mellon
$Cy_9H_6(OH)_3$, azulmic acid of Gautier
$Cy_9H_6(OH)_2OAg$, silver azulmate.

Deka-cyanides $(Cy_{10})^{X}$.

$Cy_{10}Pt_2K_4$, potassium platino-cyanide
$Cy_{10}Fe_2(NO)_2Na_4$, sodium nitro-prusside
$Cy_{10}Fe_2(N_2O_3)Na_4$, sodium nitro-prusside (Hadow).

Do-deka-cyanides $(Cy_{12})^{XII}$.

$Cy_{12}Fe_2H_8$, hydrogen ferrocyanide
$Cy_{12}Fe_2K_8$, potassium ferrocyanide
$Cy_{12}Fe_2Fe_2K_4$, potassio-ferrous ferrocyanide
$Cy_{12}Fe_2Ca_4.H_2O$, calcium ferrocyanide
$Cy_{12}Fe_2Sr_2K_{12}H_2O$, potassio-strontium ferrocyanide
$Cy_{12}Fe_2(NH_3cu)_8H_2O$, cuprammonium ferrocyanide
$Cy_{12}Fe_2(NH_3ni)_8$, nickelammonium ferrocyanide
$Cy_{12}Fe_2Fe(NH_3fe)_4$, ferric ferrammonium ferrocyanide
$Cy_{12}Ni_2K_8$, potassium nickelocyanide
$Cy_{12}Fe_2H_6$, hydrogen ferricyanide
$Cy_{12}Fe_2K_6$, potassium ferricyanide
$Cy_{12}Fe_2Ca_3$, calcium ferricyanide
$Cy_{12}Fe_2Ni(NH_3ni)_2$, nickelic nickelammonium ferricyanide
$Cy_{12}Fe_2K_3Na_3$, potassium and sodium ferricyanide
$Cy_{12}Fe_2Ag_6.3NH_3$, ammonio-silver ferricyanide
$Cy_{12}Fe_2Fe_3$, ferrous ferricyanide
$Cy_{12}Fe_4$, ferric ferricyanide (Prussian green)
$Cy_{12}Co_2K_6$, potassium cobalto-cyanide
$Cy_{12}Mn_2K_6$, potassium manganic cyanide
$Cy_{12}Cr_2K_6$, potassium chromicyanide

The formula I have used for the nitro-prussides is double that formerly given; if Hadow's formula be correct, this doubling follows of necessity; if, as Städeler's researches seem to show, that generally used be correct, the doubled formula given above still seems the best from considerations of the atomicity of iron and of the great analogy of the nitro-prussides with the ferricyanides.

Hendeka-cyanides $(Cy_{11})^{XI}$.
Wanting.

Do-deka-cyanides $(Cy_{12})^{XII}$. (See preceding page).

Octo-deka-cyanides $(Cy_{18})^{XVIII}$.
$Cy_{18}(Fe_3)^{VI}Fe_4$ (?), Prussian blue.

Besides theoretical reasons, based upon the atomicity of iron, for considering the ferro- and ferri-cyanides as containing the group CN twelve times in each molecule; the single molecule of water found by Wyrouboff in calcium ferrocyanide dried at 100°, and the three molecules of water found by the same observer in potassio-strontium ferrocyanide dried at 110°, the constitution of Laurent's potassium and sodium ferricyanide, and finally the constitution of the ammonio-silver ferricyanide furnish powerful arguments tending in the same direction.

Nickel seems to form nickelo-cyanides similar to the ferrocyanides; cobalt, manganese, and chromium form cobalti-cyanides, mangani-cyanides, and chromi-cyanides similar to the ferri-cyanides.

The formula of Prussian blue has long been a *vexata quæstio* among chemists; that given above is the older and perhaps more generally received.

(To be continued)

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

Progress in the Artificial Production of Cold and Ice.
By Dr. H. MEIDINGER.

(Continued from p. 214.)

A FEW singular proposals for effecting a reduction of temperature may be finally mentioned. J. B. Toselli, of Paris,† causes a spiral pipe to revolve in a vessel of water, from which it simultaneously, during each rotation, raises a certain quantity of water and transfers it to an adjacent vessel, whence it flows back through a worm into the former. The spiral, during its revolutions, has its entire surface moistened. A ventilator drives air against it, evaporates the adhering layer of moisture, and thus lowers the temperature of the tube and of the water it contains. A refrigeration of from 2·7° to 18·3° C. is said to be thus produced according to the weather. In the second vessel, which is traversed by a worm containing the cold water, is placed the liquid to be cooled, such as worts of beer, artificial mineral waters, &c. The effect produced can be but trifling, and depends entirely on the state of the weather, and on the amount of atmospheric moisture, which is never wanting. A psychrometer fixed in the place where the experiment is to be made will show the result beforehand with tolerable accuracy.

Ballo,‡ of Pest, produces cold by forcing very finely divided air through bisulphide of carbon. The condensation of the liquid needful for its recovery is a hindrance, on which, in fact, the entire project must be wrecked. A recovery of the bisulphide of carbon by any other means than by condensation and refrigeration of the air saturated therewith is, in the absence of suitable solvents, impossible. Even by this means it would involve much difficulty and a great expenditure of force, and would bring us back to the principle of the air machine. In this direction the problem is practically incapable of solution.

Preservation of Ice.

As a supplement to our report on the principles of the artificial production of ice, and on the apparatus hitherto devised for this purpose, a few words must be added on the arrangements for the preservation of cold in the concentrated form of ice. This is a question of great practical importance. Ice machines, however they may be eventually improved and their effect increased, will never, in the more northern parts of the temperate zone, where a moderately cold winter with frost is generally experienced, acquire importance enough to meet the demand even approximately. They will serve merely as valuable substitutes to render us independent of the fickleness of the seasons. Even in more southern regions where ice machines are the only source for obtaining ice, they must work to stock and fill magazines, since the demand does not go hand in hand with the production, but varies with the weather. There is in general no conception of the quantities of ice which certain trades require, and which are consumed in domestic life where its use has grown into a necessity. In 1866 the quantity of ice consumed in New York and its vicinity amounted to 250,000 tons (254,015 metric tons) or 5 cwts. per head. The weight stored up was 543,000 tons (551,721 metric tons), whilst the capital employed in the trade amounted to 2,160,000 dollars. The retail price was for quantities of 5 to 12 kilos. 4 pfennige* per kilo., but for quantities of 1 to 10 cwts. only one shilling per cwt.

In 1871 a company in Berlin, the "North German Ice Works," stored up 600,000 cwts. of ice, and delivered it to subscribers at 77 pfennige per cwt. The quantities of ice consumed in brewing may be learned from the following data, which the author obtained in 1869 from Dreher's brewery at Klein Schwechat, near Vienna:—This establishment brewed, in 1867, 483,150 Viennese eimers, = 273,463 hectolitres, and stored up 515,600 cwts. (28,874,219 kilos) of ice. In the following year these numbers rose to 492,499 eimers (278,754 hectolitres) of beer and 563,058 cwts. (31,531,924 kilos.) of ice. On an average 1 cwt. of ice is used per eimer (56·6 litre). In a prolonged frost of 2 months this quantity can be procured at the cost of 7 Austrian kreutzers (14 pfennige) per cwt. In shorter periods of cold the price rises to from 10 to 12 kreutzers, to which must be added 1 kreutzer for shovelling into the ice cellars. In mild winters the ice is brought in part from Styria; as the cold weather in 1869 set in late, 26,000 cwts. (1,456,031 kilos.) were procured from there, costing, by the time it reached the brewery, 115 florins per 200 cwts.

(To be continued.)

SCHEIBLER'S PROCESS FOR SACCHAROSE ESTIMATION.

By ROBERT FRAZER SMITH.

WITH reference to the very able abstract of Professor Gunning's remarks in his report upon Scheibler's process for the determination of the crystallisable cane sugar in raw sugars given by Mr. Humphrey in the *American Chemist* and copied in the CHEMICAL NEWS (vol. xxxiii., p. 205), perhaps the enclosed table of results obtained by the use of that process upon Colonial sugars by Lotmann may be of interest to those chemists who have not had time or opportunity afforded for giving it a fair trial. Owing to the results being uniformly higher than those

* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzehends."
† Toselli, *Mech. Mag.*, 1872, 433. *Dingl. Pol. Journ.*, ccv., 28.
‡ Ballo, *Dingl. Pol. Journ.*, ccxi., 343.

* The German "pfennig" is about the tenth part of an English penny.

Table of the Refining Values (Raffinations Werthes) of Different Raw Sugars.

100 Parts of the Raw Sugar Contain

Name of the Sugar used.	Crystallisable Sugar.	Glucose.	Ash.	Water.	Organic and Insoluble Matters.	Nett Sugar. Ash × 3 + Glucose × 1.	Refine Value Scheibler.	Polarisation of the Washed Product.	Remarks.
1.	2.	3.	4.	5.	6.	7.	8.	9.	
Best refined	100·0	—	—	—	—	—	99·80	—	Control trial.
,, ...	100·0	—	—	—	—	—	99·90	—	,,
Java, 15	98·2	0·47	0·234	0·20	0·896	96·56	95·09	99·6	
,, 15	94·6	1·97	0·320	1·05	1·100	91·03	91·25	99·7	
,, 13	93·0	2·56	0·220	2·90	1·320	89·34	88·67	99·6	
,, 14	97·0	1·28	0·310	0·70	0·710	94·17	94·32	99·5	
,, 12	93·5	3·00	0·240	1·80	1·460	89·30	88·52	99·0	
,, 11	95·2	1·50	0·670	1·25	1·380	90·35	91·75	99·1	
,, 8	93·5	3·00	0·770	1·70	1·030	86·65	88·60	99·1	
,, 6	89·5	4·38	0·936	2·90	2·284	80·42	82·18	98·0	1 p. c. sand.
Surinam	86·5	4·05	1·440	5·60	2·410	75·25	81·26	98·0	
,, ...	87·0	3·51	1·190	5·70	2·600	77·54	77·85	97·0	
,, ...	89·0	4·01	1·070	4·32	1·600	79·64	83·12	98·0	
Bahia	86·0	2·35	2·420	4·21	5·020	71·55	81·70	97·1	
Cuba	85·7	3·87	1·350	5·00	4·080	75·08	79·53	96·0	
Madras	82·0	6·10	2·650	6·10	3·150	62·65	76·15	93·0	
Surinam	90·5	2·98	0·900	3·58	2·040	83·02	84·12	97·0	
Porto Rico	89·0	3·40	0·480	3·61	3·510	83·20	82·91	98·0	
Manilla	87·0	5·10	1·820	4·00	2·080	72·80	78·10	94·0	Much
,, ...	83·0	5·26	2·130	5·91	3·700	67·69	72·17	94·5	sand
,, ...	85·6	4·41	1·720	4·53	3·740	72·59	81·03	94·0	and lime.
Beets									
1st product	98·0	—	0·540	1·15	0·310	95·30	95·25	99·9	
,, ...	96·0	—	1·080	1·98	0·940	90·60	91·15	99·7	
,, ...	96·5	—	1·170	2·50	0·830	90·65	91·12	99·5	
2nd product	94·5	—	1·570	2·00	1·930	85·65	88·90	99·0	
,, ...	93·5	—	1·720	2·28	2·500	84·90	89·60	99·5	
,, ...	93·7	—	1·670	3·00	1·630	85·35	87·53	99·4	
,, ...	95·5	—	1·440	1·28	1·780	88·30	89·54	99·5	
,, ...	95·0	—	1·680	1·57	1·750	86·60	89·87	99·2	
3rd product	87·0	—	4·040	4·98	3·980	60·80	75·12	98·0	

found by the French method, it probably has no chance of being adopted by the buyers of raw sugars or those acting for them; but in the private laboratories of refineries the information such a determination of the actual quantity of saccharose present in any sample gives may induce some chemists to procure or erect the apparatus. The Table will show that it is absolutely indispensable to dry all samples containing more than 2 per cent of moisture previous to treatment, in which case the ether will be unnecessary. Upon sugars containing much caramel or other colouring matter an alcoholic 3 per cent hydrochloric acid solution will be found to answer better than the acetic, giving at the end a perfectly white product.

With regard to the "amorphous sugar" it might be well to wait for more light before accepting the existence of such a body. The sugar obtained by precipitating with alcohol from a sample of molasses which has stood for a year without any signs of crystallisation, presents the appearance of an impalpable powder, and from its state of minute division is slightly more soluble in alcohol than the crystalline cane sugar of commerce, containing 99·8 per cent of saccharose, but on solution in water and evaporation it crystallises in the ordinary form. Crystalline salts dissolved in gum or gelatin behave in exactly the same manner, but no one has yet talked of amorphous common salt or nitre. Molasses containing, on dried product—

Saccharose	75·50
Glucose	0·41
Ash	11·31
Organic matters	12·78
	100·00

which a friend kindly sent me from Paris and said to be derived from the residues of the "sucrate of the hydrocarbonate of lime process" on being diluted to 30° B. and exposed to a freezing mixture to get rid of excess of salts and saccharose, the mother liquor, treated with alcoholic ether (being first concentrated) yields a large crop of what I understand to be the so-called amorphous sugar. But a glass of small power shows distinct crystalline faces, and it yields to water and evaporation, the usual result. I humbly think that the amount of crystallised sugar got from any solution of saccharine matter will be found to depend, other things being equal, upon the value which pertains to the figure denoting the coefficient of viscosity.

Some salts, such as the magnesian, instead of hindering promote sugar crystallisation. In short, the salts which take longest when in solution to transpire through capillary tubes are those which hinder crystallisation most. Hence the alkaline organic salts are the great molasses formers, and hence also the benefit derived from Marguerite's process in the beet fabriques, which adds sufficient hydrochloric acid to transform these into chlorides, the other acids being sent off in the boiling.

The rate at which any syrup travels through a capillary tube (a solution of pure sugar being 100) will express the crystallising capabilities of the sugar contained in it; due regard being had to temperature, pressure, strength, &c., being alike in the various trials. Mr. Humphrey mentions cases in which glucose is present in an optically inactive condition, but, so far as I know, this never occurs in cane sugars, but is so abundantly in date sugar and also the sugar from many fruits.

23, Roselea Drive, Glasgow.

The Loan Collection at South Kensington.—A series of lectures in connection with the above Exhibition have been arranged for the free evenings. The first lecture will be given on Saturday evening next, at 8 o'clock, in the Conference Room, by Prof. Roscoe. The subject is "Dalton's Instruments and what he did with them."

UNIVERSITY COLLEGE, BRISTOL.

THE operations of this new College will, we are glad to hear, begin in October next in the temporary premises, Park Row, Bristol. It will be remembered that the College is established for the study of science and literature for young people of both sexes above the ordinary school age residing in the West of England and South Wales. The models kept in view are University College, London, and the Owens College, Manchester. The Council consists of Prof. B. Jowett, nominated by the Vice-Chancellor of the University of Oxford; Prof. Stuart, nominated by the Vice-Chancellor of the University of Cambridge; Mr. W. Lant Carpenter, nominated by the Chancellor of the University of London; Prof. H. Smith, by Balliol College, Oxford; Rev. H. B. George, by New College, Oxford; Mr. R. W. Coe, by the Bristol Medical School; Mr. F. N. Budd (Chairman); Mr. W. Proctor Baker (Treasurer); Rev. J. W. Caldicott; Mr. Lewis Fry; Rev. F. W. Gotch; Rev. J. Percival; Mr. G. F. Schacht; and Mr. William Smith, the last eight gentlemen being elected by the subscribers. Out of 106 candidates Mr. Edward Stock, of Clare Street, Bristol, has been elected Secretary. The Council will shortly appoint a Professor of Chemistry. The necessary qualifications are, first, a good teacher; and, second, one who has done and will do original work. The Council offer £300 per year, two-thirds of the Lecture Fees, and one-third of the Laboratory Fees, the College finding the Laboratory in apparatus and chemicals, and they guarantee a minimum emolument of £400. In order to improve the technical education of those engaged in the cloth-making districts in the West of England, the Clothworkers' Company offered to the promoters of the College the subvention of 500 guineas per year for five years to assist in the establishment of a Department of Textile Industries at the College, and it is understood that special attention will be given both to the principles and detail of the mechanism employed in cloth manufacture, and also to the chemical principles involved in the processes of wool-scouring, dyeing, &c. In addition to the instruction given at the College there will probably be classes conducted in the cloth-working districts themselves, at Stroud and elsewhere.

PROCEEDINGS OF SOCIETIES.

PHYSICAL SOCIETY.

May 27th, 1876.

Professor GLADSTONE, F.R.S., Vice-President, in the Chair.

THE following candidates were elected Members of the Society:—Herbert Taylor, Rogers Field, and Channell Law.

Mr. W. ACKROYD read a paper on "*Selective Absorption.*" Two typical experiments were shown upon which a division of selective absorption may be based. In the first, light is transmitted through bichromate of potash at the normal temperature, and again at about 200° C., and the spectrum of the transmitted light is examined. The widening of the absorption-bands, which takes place at the higher temperature, is traced to structural alterations. In the second experiment, light is sent through two thicknesses of the same coloured solution—as, for example, sulphate of copper—and in the greater thickness the absorption-band has widened out; but this is plainly not owing to any structural alteration. That in the first experiment he proposes to term *structural*, and that in the second *transverse* absorption, and he considers that these two kinds have not hitherto been sufficiently distinguished. Certain colour relations which exist among anhydrous binary compounds led the author to the conclusion that the width of a structural absorption-band bears a direct relation to interatomic distance. The necessity for separating high temperature spectra from low was shown, and the bearing of the subject on the study of organic colouring matters briefly alluded to.

The SECRETARY then read a communication from the Rev. R. Abbay, "*On certain Remarkable Atmospheric Phenomena in Ceylon.*" The most striking of these is witnessed from the summit of Adam's Peak, which is a mountain rising extremely abruptly from the low country to an elevation of 7200 feet above the sea. The phenomenon referred to is seen at sunrise, and consists *apparently* of an elongated shadow of the mountain, projecting westward to a distance of about 70 miles. As the sun rises higher it rapidly approaches the mountain, and appears at the same time to rise before the observer in the form of a gigantic pyramid of shadow. Distant objects may be seen through it, so that it is not really a shadow on the land, but a veil of darkness between the peak and the low country. It continues to rapidly approach and rise until it seems to fall back upon the observer, like a ladder which has been reared beyond the vertical, and the next instant it is gone. Mr. Abbay suggest the following explanation of the phenomenon:—The average temperature at night in the low country during the dry season is between 70° and 80° F., and that at the summit of the peak is 30° or 40° F.; consequently, the low strata of air are much the less dense, and an almost horizontal ray of light passing over the summit must be refracted upwards and suffer total internal reflection, as in an ordinary mirage. On this supposition the veil must become more and more vertical as the rays fall less horizontally, and this will continue until they reach the critical angle, when total internal reflection ceases, and it suddenly disappears. Its apparent tilting over on the spectator is probably an illusion, produced by the rapid approach and the rising of the dark veil without any gradual disappearance which can be watched and estimated. It will be evident that the illumination of the innumerable particles floating in the atmosphere causes the aërial shadow to be visible by contrast. Another interesting phenomenon visible in the mountain districts admits of an equally simple explanation. At times broad beams, apparently of bluish light, may be seen extending from the zenith downwards, converging as they approach the horizon. The spaces between them have the ordinary illumination of the rest of the sky. If we suppose, as is frequently the case, that the lower strata of air are *colder* than the upper, the reflection spoken of in the case of Adam's Peak will be downwards instead of upwards. If several isolated masses of clouds partially obscure the sun, we may have several corresponding inverted veils of darkness, like blue rays in the sky, all apparently converging towards the same point below the horizon. This latter phenomenon is called by the natives "Buddha's Rays."

Prof. Dr. FOREL, of Morges, Switzerland, then gave, in French, an account of some interesting observations which he has recently made on the periodic waves which take place on the Swiss lakes, and are there called "Seiches." It was long since observed that the waters of most of these lakes are subject to a more or less regular rise and fall, which at times have been found to be as much as 1 or 2 metres. M. Forel has studied this phenomenon in nine different lakes, and finds that it varies with the length and depth of the lake, and that the waves are in every way analogous to those already studied by Prof. Guthrie in artificial troughs, and follow the laws which he has deduced from his experiments. Most of the observations in Switzerland were made on the Lake of Geneva, but that of Neuchatel was found to be best fitted for the study of the subject, possessing as it does an extremely regular geometric form. The apparatus he employed was very sensitive to the motion of the water, being capable of registering the waves caused by a steamboat half an hour after it had passed, and five minutes before its arrival, and was so constructed as to eliminate the effect of common

waves, and to register the motion side by side with a record of the state of the barometer, on paper kept in continuous motion. While he found the duration of waves to be ten minutes at Morges, it was seventy minutes at Geneva, and this is explained by the narrowness of the neck of the lake at the latter place. This period he proves to be independent of the amplitude, and to be least in the shortest lakes. For shallow lakes the period is lengthened, and his observations show that the period is a function of the length and depth, and that longitudinal and transverse waves may coexist, just as Prof. Guthrie has shown to be the case in troughs.

M. FOREL, replying to a question by the President, stated that he considers the origin of the oscillations to be in many cases barometric disturbances, but occasionally blows given by the wind. He has observed that the movements are, as a rule, higher when the barometer is low than when it is high, and he considers that the highest recorded are in all probability due to some convulsion of the earth.

M. BOSANQUET said that the quantity of water flowing into the Lake of Geneva from the Rhône is not a matter of indifference, as this must show itself as a wave on the lake, which would be liable to be confounded with the influence of barometric pressure unless special precautions are taken to avoid such an error. He also considered that in a lake of so complicated a form as that of Geneva observations would be required at at least ten different points, and a complete solution of such a case would be analogous to the study of magnetic intensity in the manner suggested by Gauss.

NOTICES OF BOOKS.

Science made Easy: A Series of Familiar Lectures on the Elements of Scientific Knowledge most required in Daily Life. By THOMAS TWINING. London: Chapman and Hall.

THIS work is not, as the title might possibly seem to imply, one of the many elementary treatises for private study which have recently appeared in such numbers and variety. The lectures are arranged for delivery at popular institutions, schools, &c., on the so-called binary principle. Two persons are required, the *reader*, who gives his undivided attention to the delivery of the text before him, and the *demonstrator*, who, in like manner, is solely concerned with preparing and performing the experiments and exhibiting the specimens or models required in illustration of the subject. This plan is undeniably good for amateur lecturers, who are very apt to become confused amidst their complicated duties and, in consequence, to bungle in their experiments. The object of the course of lectures, the spread of sound scientific information, and yet more of scientific habits of thought among the general public—and especially among the working classes—is most important, and we must wish the author every success in an undertaking of such great national moment. At the same time it must not be forgotten that in the second quarter of the present century public lectures on scientific subjects were delivered in abundance at Mechanics' Institutes and similar establishments all over the kingdom. The lecturers of those days were often able men, good elocutionists, and skilful experimentalists, and for a time lectures on chemistry and certain branches of physics were very popular. Nor can it it be denied that real and enduring good was effected. Many men were led to take science home with them to the workshop, and to carry on their daily work on the only sound principle, "theory with practice." At the same time somewhat clearer and more rational views were diffused among the general public. But, despite these admitted benefits the interest in scientific lectures gradually fell off. Subjects of a more "human interest"—*i.e.*, such as required less thought on the part of the audience—took their place in our popular scientific institutions, and the scientific lecturer of the thirties and forties became, as a species, extinct. We, therefore, fear that as a "commercial speculation" the delivery of Mr. Twining's lectures would prove a failure. But if taken up by some educational authority and delivered at schools, &c., they would doubtless be of great benefit.

As regards the lectures themselves they are, as a matter of course, extremely elementary. Their simplicity of language and freedom from all those phantastic and unproved hypotheses, so common at the present day, are highly to be commended. The reader who wishes for further details will find in connection with each lecture a list of suitable works for private study.

Food Chart. By R. LOCKE JOHNSON, L.R.C.P., &c. London: Hardwicke and Bogue.

THIS publication is intended to give the names, classification, composition, alimentary value, rates of digestibility, adulterations, tests, &c., of the alimentary substances in general use—the whole drawn up on a broad sheet adapted for the wall of the study, the office, the board room, &c. Accurate information of this kind is very much wanted in official, as well as in private quarters, *e.g.*, by boards of guardians, visiting justices of prisons, and, in short, by all who have to decide on the scale of dietary of any large establishment, and this the more as such bodies are too apt to turn a deaf ear to the advice of their medical officers. The idea of this chart must, therefore, be pronounced happy.

The execution, however, might have been much improved if the author had taken a little more care. Thus we are told that "carbo-hydrates conduce to the production of fat. They consist of starch, cane sugar, grape sugar, lactin (milk sugar), inosite (muscle sugar), amyloid substances, gum, dextrin, cellulose, woody fibre, &c., &c." Why are the amyloid substances separated from starch? Whether cellulose and woody fibre are chemically distinct is, to say the least, very doubtful, and their power of becoming assimilated in the human economy and of "conducing to the production of fat" does not even admit of a doubt. They are evacuated unchanged. In the table of vegetable alimentary substances we find the onion omitted from the class of "roots and tubers," and banished to the "herbaceous substances." The "varieties of sugar," we learn, are "cane, grape, beet, maple, and starch sugars." This is exceedingly apt to mislead the ordinary reader; grape and starch sugar differ from cane sugar in their chemical composition and their properties, whilst beet-root sugar is identical with cane sugar, although obtained from a different source. Concerning rice we find the astonishing statement that the "ash should range from 80 to 85 per cent." Under the head "sausages, pork-pies, and preserved meats in tins or otherwise, Australian, South American, &c.," the adulterations met with are said to include saw-dust (!) and "productive portions of animal miscellanea"—whatever that may mean. Among the sophistications of wine, of which a tolerably full list is given, we find no mention of sulphate of lime.

Typographical errors are also numerous, and many of them are of a nature calculated to bewilder the uninitiated. We hope that in case of a second edition this chart will undergo a thorough revision.

The Royal Society.—At a meeting held yesterday the following gentlemen were elected Fellows of the Royal Society:—Capt.-William de Wiveleslie Abney, R.E.; Prof. Henry Edward Armstrong, Ph.D.; Rev. William B. Clarke, M.A., F.G.S.; James Croll, F.R.S.E.; Edwin Dunkin, Sec.R.A.S.; Prof. John Eric Erichsen, F.R.C.S.; David Ferrier, M.A., M.D.; Col. Augustus H. Lane Fox; Prof. Alfred Henry Garrod, M.A.; Robert Baldwin Hayward, M.A.; Charles Meldrum, M.A., F.R.A.S.; Edward James Reed, C.B.; Prof. William Rutherford, M.D.; Robert Swinhoe, F.R.G.S.; Prof. Thomas Edward Thorpe, Ph.D.

CORRESPONDENCE.

THE CHEMICAL SOCIETY.

To the Editor of the Chemical News.

SIR,—Might I be permitted to make a few remarks on the two letters on this subject which appeared in your last. History repeats itself. It is a misfortune that at some period or other in the existence of every corporate society, whether it be scientific, social, or religious, a few young men—they are invariably young men—having managed to get themselves admitted Members of the Society, conceive that it is their duty to try and reform it. These six or eight young men form themselves into a "clique," and with more zeal than discretion proceed to blackball everyone they do not know. As their personal knowledge of the qualifications of the candidates is in most cases somewhat limited, the result is more curious and instructive than agreeable, although not unentertaining to a student of human nature if he be not interested in the welfare of the Society. The Chemical Society is passing through such a crisis.

It will be evident that as by the bye-laws of the Society one negative ball neutralises three affirmative ones, Messrs. "Nuntius" and "Twig," with the help of four or five friends, can easily blackball all the candidates if the meeting is thinly attended, as was the case on May 6th, or if only a small number of those present go up to vote. That the majority does not approve of this process of rejection, or even an important section of the Fellows, was clearly shown by the way in which the President's remarks on the subject were received at the last meeting. These, so far from being merely tolerated "from the great respect entertained for the speaker," as stated by Mr. Twig,* were received with what newspaper reporters term "unbounded applause."

If a candidate is blackballed whom the President of the Society and other well known chemists—Professors in our Universities and Colleges—assert of their *personal knowledge* to be a fit and proper person to be elected a Fellow, it means one of two things—either that these gentlemen have knowingly proposed a notoriously unfit person, or that the blackballers are much better judges of the candidate's qualifications (whose name in all probability they have never heard before) than the eminent chemists who have signed his certificate from *personal* knowledge.

The letter of "Nuntius" seems to be straightforward and to the point. The writer evidently thinks the Chemical Society is a close society, and that those who are not professional chemists should be rigidly excluded. The formation of such a chemical institute is much to be desired, but if "Nuntius" had taken the trouble to look over his "Charter and Bye-laws" before he wrote his letter, he would have seen that the Chemical Society was founded with a very different object: not as a kind of trades' union, or for the purpose of conferring honorary degrees, but for "the promotion of chemistry and those branches of science immediately connected with it," or as it is in the Charter, "For the general advancement of Chemical Science." Might I, in all humility, suggest to the consideration of "Nuntius" and his friends that it is scarcely justifiable to make use of the power given to the minority by the vote by ballot for the purpose of virtually altering the constitution of a society.—I am, &c.,

CHARLES E. GROVES.

May, 27, 1876.

To the Editor of the Chemical News.

SIR,—Though not a Fellow of the Chemical Society, I am very pleased to learn from the correspondence in the CHEMICAL NEWS that there has been some extensive blackballing of candidates for admission to that honour. It is sad to see the manner in which titular letters are used in order to deceive the public, and all who have any respect for our "learned" (as they ought to be) societies would like to see extensive curtailing of admissions. If money is required would it not be possible to have Associates, and reserve the title "Fellow" to those who can show some other claim to it than the recommendation of a few friends?—I am, &c.,

C. J. W.

To the Editor of the Chemical News.

SIR,—Your correspondents of last week have told us with what object the systematic blackballing at the Chemical Society has been carried on. It is well that the reasons of this proceeding should be at last plainly stated. Will you kindly allow me space for a few remarks on the question?

The Chemical Society clearly stands on the same footing as the Linnean, Geological, Physical, and other scientific societies. The object of such societies may be well expressed in the words of the resolution adopted at the formation of the Chemical Society, namely, "the promotion of . . . Science . . . by the reading, discussion, and subsequent publication of original communications." These societies do not seek to advance Science by exercising the functions of an examining body; their sphere of action is quite different, and may be briefly described as the stimulation of original research. To be a Fellow of one of these societies does not stamp a man as a good chemist, a good botanist, or a good geologist; it simply implies that the person in question is one who has a genuine interest in these sciences, and wishes to enjoy the facilities which the respective societies afford. The attempt to create any one of these societies into a tribunal to judge of the scientific attainments of candidates, and thus to give the character of a diploma to the admission into Fellowship, is therefore clearly founded on a mistake of the purpose for which such societies were founded.

It is quite true that when a science like chemistry acquires such practical importance that it is adopted as a profession, some means of discriminating the worthy from the unworthy professors becomes urgently needed. But if this is the case, let an appropriate examining machinery be at once sought for, after the model of the medical and other licensed professions. Such a movement would obtain the support of the majority of chemists, and would surely be far better than trying to force the Chemical Society into an unnatural position.

But if the object which your correspondents avow is a mistaken one, and foreign to the fundamental idea of a scientific society, I venture to think that their mode of attaining that object is still more mistaken. The gentlemen who systematically blackball at the Chemical Society are continually condemning persons of whom they know nothing; a proceeding which in other places would be considered most unjust and absurd. A short time since a gentleman well known to the older Fellows of the Society was a candidate for Fellowship. He was a man of original scientific thought, and had a large practical experience of chemistry. His certificate set forth that he was a Fellow of various scientific societies, and that his occupation was that of "merchant." The certificate was signed from personal knowledge by a number of our best known chemists. The word "merchant" was, however, fatal to him, and he was blackballed. A few months after he was again put up by his friends, and this time described as "chemical manufacturer" (a statement which was perfectly true); he was then elected without a single negative vote!

This is a fair illustration of the folly of the present blackballing system. The gentlemen who exercise this function will not accept the positive testimony of a number of eminent men to whom the candidate is personally known; they at once reject the candidate, though they know nothing against him, because his business occupation is that of Merchant! Surely in cases where a candi-

* The name of Twig does not occur in the list of Fellows; if it is a *nom de plume* it is singularly infelicitous.

date is not personally known to a voter, his fitness to be elected should be decided by the testimony of those to whom he is well known, and not by the nature of his daily occupation.

I may add, in conclusion, that the system of rejecting all candidates who do not declare themselves as chemists, can have no effect in checking the real abuse of the letters F.C.S., namely, the employment of them for the purpose of advertisement. It is the chemists who are not gentlemen, and not the gentlemen who are not chemists, who are most likely to sin in this respect. The only plan of dealing with this real, though happily limited evil, is by making some addition to the obligation clause signed by all Fellows, as already suggested by Dr. Williamson.—I am, &c.,

R. Warington.

May 30, 1876.

To the Editor of the Chemical News.

Sir,—Having just read a letter in the Chemical News (vol. xxxiii., p. 220), headed "Blackballing at the Chemical Society," I beg to draw attention to the following words:—"In brief, it was intimated that the Fellows ought not to use their individual judgment, and that the 'blackballing' was indiscriminate." "If this latter be true it is a grievous fault, and calls for immediate rectification." I take the liberty of pointing out that that which the writer calls a "grievous fault" was committed on the evening of May 4, and therefore calls for "immediate rectification." One rejected candidate was most thoroughly well qualified in every respect for the Fellowship of the Society: after a very complete course of study in London and Heidelberg he is now engaged in research work. It cannot be urged that his qualifications were not plainly stated on his certificate, and no one who has the pleasure of his acquaintance can possibly imagine that personal dislike was the cause of his rejection. Duties elsewhere generally prevent my being present at the voting, and I am unaware what proceedings have usually taken place, but that some care should be exercised in the signing of certificates I think is desirable in order to prevent the humiliating spectacle of a learned society proceeding to elect or reject by ballot a distributor of worthless degrees or a promoter of bogus companies.—I am, &c.,

Walter Noel Hartley.

King's College, London, May 30.

To the Editor of the Chemical News.

Sir,—It was with unqualified satisfaction that I read the letters of "Twig" and "Nuntius" in your last issue. I hail them as evidence of a feeling, rapidly gathering strength, which is calculated, in my opinion, to give to the Chemical Society a much better position than that which it has held for some time.

I have often heard the Fellowship of the Society spoken of in words of open contempt, and recent movements among chemists show that my experience is by no means a solitary one. It is hardly two months since a chemist, well skilled in his profession, spoke about the Chemical Society as one which it was not worth joining. If we come to examine the grounds on which such an assertion could be made we discover the justification of that course which Professor Abel so strongly condemned on the 18th instant.

It cannot be denied that the Chemical Society numbers amongst its members the majority of the best chemists in England, and if we looked at this fact alone it would be difficult to say how its reputation had fallen so low. But when we consider that many of these chemists habitually slight the Society by absenting themselves from its meetings, and when we find that many of its Fellows pretend to no chemical qualification whatever, we see the cause of the present discontent among working chemists.

Now, as all the present Fellows have been proposed according to rule, it would appear that there must be either some laxity on the part of those who propose, or else very different opinions as to who are fit and proper persons for election.

It is on this last point that Professor Abel differs so strongly from your correspondents. A man who is a chemist by profession is evidently eligible, but how much further you can go with profit to the Society is a question which receives very different answers from different persons.

I, like your correspondents of last week, accept only a chemical qualification, and in so doing sincerely believe that my action will tend to advance the chemistry of our country.—I am, &c.,

Bee.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances, de l'Academie des Sciences. No. 19, May 8, 1876.

On Osmium.—MM. Ste.-Claire Deville and H. Debray.—Osmium as obtained by the authors has a fine blue colour, shaded with grey. It forms small crystals, either cubic or rhombohedric, closely bordering upon the cubic form. It is harder than glass, which it scratches with ease. It is the heaviest body known, its specific gravity being 22·477. Crystalline osmium is obtained by passing the vapour of osmic acid, repeatedly rectified, over pure carbon. The sesquioxide of osmium is frequently deposited in the tube in crystalline scale of a fine coppery-red. It is permanent in the air, and consists of—

Osmium	89·13
Oxygen	10·87
	100·00

Note on Fermentation, with reference to the Views of Drs. Brefeld and Traube.—M. L. Pasteur.—The author announces that the chemists just mentioned have withdrawn their objections to his views.

Electric Transmissions without Conducting Wires, with reference to the Recent Communications of MM. Bouchotte and Bourbouze.—M. Th. du Moncel.—The author explains that the idea of communication without wires is far from novel, having been experimentally tested thirty years ago, both in England and America. Thus, messages were sent from Gosport to Portsmouth (and, we believe, across to the Isle of Wight), a distance of about 3 kilometres.

Calcareous Alabaster from Mexico.—M. A. Damour.—This material is known in commerce as the onyx of Tecali. It varies in colour from milk-white, yellowish white to pale green, certain samples displaying brown veins shading into red. It takes a fine polish. Its specific gravity is 2·77. It is readily and entirely soluble in nitric acid. Its composition is—

Carbonic acid	43·52
Lime	50·10
Magnesia	1·40
Fertous oxide	4·10
Manganous oxide	0·22
Water	0·60
Silica	traces
	99·94

Extraction of Gallium from its Ores.—M. Lecoq de Boisbaudran.—The blende is dissolved in *aqua regia*, and pieces of sheet-zinc are placed in the liquid, and withdrawn when the escape of hydrogen has greatly subsided,

but is still perceptible. In this manner is separated the greater part of Cu, Pb, Cd, Ir, Tl, Ag, Hg, Se, As, &c. To the clear liquid zinc is added in large excess, and it is boiled for several hours, when an abundant precipitate is formed, containing alumina, sub-salts of zinc, and gallium. This precipitate is re-dissolved in hydrochloric acid, and the solution boiled again with zinc. All the gallium present is thus concentrated in a liquid of small bulk. The last gelatinous precipitate is dissolved in hydrochloric acid, acetate of ammonia is added, and the solution treated with sulphuretted hydrogen. This operation is repeated for the complete removal of the alumina. The hydrochloric solution of the white sulphides is precipitated fractionally with carbonate of soda, when the gallium is found concentrated in the first portions deposited. The spectroscope indicates the point at which it is necessary to stop. To complete the separation of the zinc, the oxide of gallium is dissolved in sulphuric acid, and then supersaturated with ammonia in excess. The gallium which remains in the ammoniacal solution may be expelled by boiling to expel free ammonia, destroying the ammoniacal salts with *aqua regia*, and fractional precipitation with carbonate of soda. The pure oxide of gallium precipitated by ammonia is dissolved in potassa and submitted to electrolysis, when gallium is deposited on the negative platinum electrode. The positive electrode, likewise of platinum, should be larger than the negative. Five or six Bunsen elements are sufficient to decompose 20 to 30 c.c. of the concentrated solution. On placing the negative electrode in cold water, and bending it, the gallium is easily detached. The author has sought for gallium in the following substances:—

A. *Rich Substances.*—Black blende from Beusberg (specimens sent by the Vieille Montagne Mining Co.); yellow transparent blende from Asturias; brown blende from Pierrefitte (Pyrenees).

B. *Rather Poor Substances.*—Powdered zinc from the Vieille Montagne; zinc dross from Corphalie (?)

C. *Very Poor Substances.*—Yellow opaque blende from Mandesse (Gard); brown blende from Sweden; black-brown blende from Schwarzenberg, in Silesia; blende in rods from Nouvelle Montagne. No gallium was found in the following,—Ribbon blende from Vieille Montagne; tuty from Corphalie; galenas from Pierrefitte and elsewhere; metallic zinc from Vieille Montagne, as used at Cognac for building purposes; calamines from Sardinia and Le Gard; commercial hydrochloric and nitric acids.

Influence of Carbonic Acid on the Respiration of Animals.—M. F. M. Raoult.—The author concludes that the presence of carbonic acid in the air inspired is an obstacle to hæmatosis.

Acetyl-persulpho-cyanic Acid.—M. P. de Clermont.—Not suitable for abstraction.

Interchange of Ammonia between the Atmosphere and Vegetable Soil.—M. Th. Schlœsing.—The experiments undertaken show that the soil derives, in general, ammonia from the atmosphere.

Action of Zinc on Solutions of Cobalt.—M. Lecoq de Boisbaudran.—It is correctly supposed that the salts of cobalt are not precipitated by zinc, whether in the cold or at a boiling heat. Nevertheless, sometimes considerable quantities of zinc are found in the metallic sponge produced by the action of zinc upon the solution of blende in *aqua regia*. The following observations have been made as to the cause of this peculiarity:—The presence of a metal readily reduced by zinc is necessary. Copper and lead may carry down cobalt, especially the former. Cadmium gives only negative results. If the liquid containing copper and cobalt is very acid the copper alone is deposited. It is only in liquids bordering closely upon neutrality that the deposition of copper induces that of cobalt also, when the liquid is quickly decolourised. In a solution rendered basic by prolonged contact with zinc cobalt, far from being reduced, is re-dissolved if it has been previously separated. To decolourise the liquid anew, it is sufficient to add a very small quantity of acid. The cobalt is reduced to the metallic state, and resists dilute acetic acid. Hydrochloric acid attacks the metallic sponge slightly, with evolution of hydrogen, but the action soon ceases. This reaction shows that the copper and cobalt are intimately mixed. A metallic sponge contained four-fifths of its original amount of cobalt after remaining for forty-eight hours in concentrated hydrochloric acid. The presence of a certain amount of a salt of copper is necessary.

Existence of Mercury in the Department of l'Herault.—M. N. Thomas.—Mercury has been found in certain places indicated. Nothing is said as to the quantity.

Action of Hydriodic Acid upon Quercite.—M. L. Prunier.—Not adapted for abstraction.

Analysis of the Native Magnetic Platinum of Nischne-Tagilsk (Ural).—M. Terreil.—A specimen of the platinum gave, on analysis,—

Platinum, with traces of iridium	81·02
Osmide of iridium and platinum metals insoluble in *aqua regia*	3·33
Silver	traces
Copper	3·14
Iron	8·18
Nickel	0·75
Chrome-iron (Cr_2O_3, 1·75; FeO, 1·01; Al_2O_3, 0·37)	3·13
Silica	0·13
Alumina, magnesia, and iron in the state of silicates	traces
	99·68

Reimann's Farber Zeitung, No. 16, 1876.

A blue shade of eosin is now in the market which gives upon wool a colour resembling cochineal ponceau. The dye is soluble in water, and has a strong affinity for wool, no mordant being required except hyposulphite of soda.

It is announced that Dr. F. Springmühl, editor of the rival tinctorial journal, the *Muster-Zeitung*, is at present in prison in Vienna. In connection with this affair Dr. Reimann speaks of the "horrible condition" of the technological press of Germany.

Gazzetta Chimica Italiana. Anno vi., 1876, Fasc. iii.

Researches on Usnic Acid, and on Two New Principles which accompany it in Zeora Sordida.—E. Paterno.—The author describes the preparation of usnic acid, to which he assigns the formula $C_{18}H_{16}O_7$, in preference to $C_{18}H_{18}O_7$, as proposed by Hesse and Stenhouse. He further examines its behaviour with hydrochloric, nitric, and sulphuric acids; with bromine; with a mixture of sulphuric acid and bichromate of potash; with anhydrous phosphoric acid, zinc turnings, chloride of acetyl, and anhydrous acetic acid; with alcohol, with which, if heated in a closed tube, it yields decarbousnic acid, $C_{15}H_{36}O_5$. The two new accompanying principles are zeorin, $C_{13}H_{22}O$, and sordidin, $C_{16}H_{15}O_7$.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

Improvements in the treatment of gases, liquids, and pulverulent substances, and in the machinery or apparatus employed therein. J. H. Johnson, Lincoln's Inn Fields, Middlesex. (A communication from A. J. Huet and A. E. Geyler, Paris.) February 24, 1875.—No. 681. This invention relates to the application of centrifugal force for bringing into contact the molecules of various bodies (gaseous, fluid, or in a pulverised condition) in order to obtain in a continuous man-

ner and in a limited space considerable acting surfaces, and thus to facilitate by its acceleration the absorption or the separation of the elements composing a mixture of gases, fluids, or pulverulent substances.

Improvements in the production of soluble phosphates of lime. J. T. Way, Russell Road, Kensington, Middlesex. February 24, 1875.—No. 686. This Provisional Specification describes—(1) An improved method of producing chloro-phosphate of lime, a compound of the acid phosphate of lime with chloride of calcium. (2) Means of separating chloride of calcium from chloro-phosphate of lime, leaving the phosphate of lime in a pure or nearly pure state.

An improved prism for spectroscopic and other purposes. J. Beck, Cornhill, London. (A communication from J. W. Queen and Co., New York, U.S.A.) February 25, 1875.—No. 689. This invention consists in the construction of a prism either hollow and filled with bisulphide of carbon or other dispersive fluid, or solid of glass or other transparent substance in such a manner that the incident ray and the mean ray of the emergent pencil shall be in the same right line: that is, the action of the prism is direct, giving obvious advantages over the common form.

Improvements in the treatment of alunite, or of natural products containing the same, so as to obtain aluminous compounds therefrom. J. H. Johnson, Lincoln's Inn Field, Middlesex. (A communication from La Société Financière de Paris, Paris.) February 25, 1875.—No. 704. The essential points of this invention are—Effecting the production of alum from alunite by the employment of a solution of sulphuric acid or of alum, or of mixtures of the same, and effecting the separation of any iron the solution may contain by the addition of potash, or of alumina, or alunite.

Improvements in apparatus and processes for the treatment of auriferous and other ores and metallic compounds. D. G. Fitzgerald, Brixton, Surrey. February 26, 1875.—No. 713. The invention relates to the treatment of ores or oxidisable substances in a converting vessel containing nitric acid, or this acid in admixture with other mineral acid. By means of a tube communicating with the external atmosphere air is forced or drawn through the mixture of the oxidisable substance and acid. Heat may, if necessary, be applied to the mixture contained in the converting vessel, which latter is connected with a receiver in which any volatilised acid may be condensed. This receiver is by preference connected with the lower portion of the converting vessel in such a manner that the condensed acid may be allowed to flow back into the latter. The receiver is connected with three or more Woolfe's bottles or other equivalent vessel, respectively containg substances by which the vapours, such as nitrous acid, peroxide of nitrogen, which have escaped condensation in the receiver may be absorbed.

An improved method of and apparatus for simultaneously disinfecting, deodorising, disintegrating, and desiccating animal and vegetable matter for fertilising purposes. J. Cox, Great Grimsby, Lincoln. February 26, 1875.—No. 723. According to my invention the matters or substances to be treated are agitated by peculiarly constructed knives or stirrers borne on a shaft in a closed cylinder, into which deodorising agents, together with steam and hot air, are injected.

Improved means for discharging calcined ores from the furnace, or crushed ores from other sources, and for washing and separating such ores. J. Hall, Chacewater, Cornwall. February 27, 1875.—No. 731. The calcined ore falling from the furnace is first sifted, and the finer portions conducted through a tube by means of a screw conveyor into a wetting-chamber, where it is cooled by a stream of water. The mixture of ore and water next passes to a separator, the fine ore being conducted to the buddle, and the larger portions to be re-stamped, as are also the lumps rejected in the first sifting.

NOTES AND QUERIES.

*** Our Notes and Queries column was opened for the purpose of giving and obtaining information likely to be of use to our readers generally. We cannot undertake to let this column be the means of transmitting merely private information, or such trade notices as should legitimately come in the advertising columns.

Urine, &c.—Can any reader state reliably the average number of ounces of urine and number of ounces of feces voided daily per head of the population; also the percentage of nitrogen and of phosphorus or phosphoric acid in each? If so, he would much oblige.—ARTIFICIAL GUANO.

MEETINGS FOR THE WEEK.

MONDAY, 5th.—Royal Institution, 2. General Monthly Meeting.
TUESDAY, 6th.—Royal Institution, 3. "Wheatstone's Discoveries," by Prof. W. G. Adams.
—— Zoological, 8.30.
WEDNESDAY, 7th.—Geological, 8.
—— Microscopical, 8.
THURSDAY, 8th.—Royal Institution, 3. "On Voltaic Electricity." by Prof. Tyndall, D.C.L., LL.D., F.R.S.
FRIDAY, 9th.—Royal Institution. Weekly Meeting, 8. 9. "On the Parallel Roads of Glen Roy," by Prof. Tyndall. (Close of the Season).
—— Astronomical, 8.
—— Quekett Microscopical Club, 8.
—— Anthropological, 8.
SATURDAY, 10th.—Royal Institution, 3. "On King Arthur's Place in English Literature," by Prof. Morley.
—— Physical, 3.

TO CORRESPONDENTS.

D. C. L.—Your question respecting valonia is only suitable for our advertisement columns.

H. S. C.—Consult Richardson and Watt's "Chemical Technology." Papers on the subject have also appeared in this Journal.

V. Cavell.—The method is given in all text-books devoted to organic chemistry. You can purchase a small quantity at any wholesale chemist's.

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CONTENTS OF No. VI.—JUNE, 1876.

Effect of Chemical Treatments upon the Tensile Strength of Cotton, by Charles O'Neill, F.C.S.—Materials for a History of Textile Colouring (No. 2)—Researches upon the Relation of the different Colouring Matters of Madder to one another, and the part they take in Dyeing, by M. A. Rosenstiehl—Upon India-rubber Coated Bowls for Machine Printing—Upon the Method of Transferring Designs to Copper, by M. G. Witz—Steam Blue from Indigo—Critical and Historical Notes concerning the Production of Adrianople or Turkey Red, and the Theory of this Colour, by Theodore Chateau (continued)—Abridgments of Complete Specifications of Patents Recently Published—British and Foreign Patents, from the Commissioners of Patents Journal, April 21 to May 23, 1876, inclusive.

Manchester: PALMER & HOWE, London: SIMPKIN & CO.

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THE CHEMICAL NEWS.

Vol. XXXII. No. 863.

ON SOME ISOMERIDES OF ALIZARIN.*

By EDWARD SCHUNCK, Ph.D., F.R.S., and HERMANN ROEMER, Ph.D.

Considering the importance of everything connected with the history of alizarin, we have been induced to undertake the study of such of the isomerides of that body as we have been able to obtain. These isomerides are interesting from a theoretical point of view, as presenting a problem with regard to internal constitution which has not yet been solved, and technically some of them are interesting as they occur along with artificial alizarin and not being available for tinctorial purposes are the source of loss to the manufacturer. The isomerides of alizarin hitherto observed are the following:—

1. *Purpuroxanthin*, a body first obtained by Schützenberger from commercial purpurin, and afterwards prepared artificially by the action of reducing agents on purpurin. It crystallises in yellow needles, soluble in alkalies with a blood-red colour.

2. *Isoalizarin*, a substance derived from madder and described by Rochleder, having properties very similar to those of purpuroxanthin, and perhaps identical with it.

3. *Frangulic Acid*, a substance also very similar to purpuroxanthin, obtained by Faust by the decomposition of frangulin, a constituent of the bark of Rhamnus frangula.

4. *Anthraflavic Acid or Anthraflavin*, a body accompanying artificial alizarin, first described by one of the authors in a paper read before this Society,† and subsequently examined by Mr. Perkin. Its isomerism with alizarin was established by Mr. Perkin, who was the first to obtain it in a state of perfect purity. It is easily distinguished by the colour of its alkaline solution, which is yellow.

5. *Anthraflavon*, a product obtained by the action of diluted sulphuric acid on oxybenzoic acid. We have not yet had an opportunity of preparing and examining this body, but on reading the description of it given by its discoverers, Barth and Sennhofer, it is evident that it bears a strong resemblance to the preceding.

6. *Quinazarin*, obtained by Baeyer, by the action of phthalic acid on hydroquinon. Of all the isomerides it most resembles alizarin itself. Its alkaline solutions have the same violet colour as those of alizarin, and it dyes mordants, while the other isomerides have no tinctorial properties.

7. *Chrysazin*, a body formed by the action of nitrous acid on hydrochrysammide, and carefully examined by its discoverer, Liebermann. By the action on it of strong nitric acid it yields chrysammic acid, the nitro acid first obtained from aloes by one of the authors many years ago.

To these we have now to add—

8. *Isoanthraflavin*, a substance accompanying artificial alizarin, generally found along with anthraflavin in the commercial product, and which we shall describe presently.

Chrysophanic Acid, the crystalline colouring matter of rhubarb, which at one time occupied a place in the list, has been erased, since it has been shown by Liebermann that it is in reality a homologue of alizarin, having the formula $C_{15}H_{10}O_4$, and is derived, not from anthracen, but from a methylanthracen.

We propose in this paper to give an account of some experiments on two of these isomerides, viz., anthraflavic acid and the one generally accompanying it, which we have lately observed for the first time.

* A Paper read before the Manchester Literary and Philosophical Society.

† "Memoirs," 3rd series, vol. v. p. 227.

Anthraflavic Acid or Anthraflavin.

We have little to add to the description of this substance given in the paper above referred to. Its melting-point is above 330° C. It is less soluble in glacial acetic acid than in alcohol. The analysis of a carefully purified specimen of the substance gave numbers agreeing exactly with the formula $C_{14}H_8O_4$, and confirming the results obtained by Perkin. The barium salt, which has been previously described, loses, when dried over sulphuric acid, a considerable quantity of water, becoming at the same time much lighter in colour. On being now heated at a temperature of 150° to 180° C. it loses two molecules of water, and the dried salt has a composition corresponding with the formula $C_{14}H_6BaO_4$. Our results do not quite agree with those of Perkin, who found the formula of the salt dried at 180° to be $2C_{14}H_6BaO_4.H_2O$.

Tetrabromanthraflavin, $C_{14}H_4Br_4O_4$, is prepared by adding bromine in excess to an alcoholic solution of the substance. It crystallises in yellow needles, which are almost insoluble in the usual menstrua, such as alcohol, benzol, and glacial acetic acid.

Nitroanthraflavic Acid, a body already referred to in the paper of 1871, is prepared by dissolving anthraflavin in fuming nitric acid, and after allowing to stand for some time, adding water, which precipitates the nitro acid as a light yellow crystalline powder. It is obtained on spontaneous evaporation of its alcoholic solution in large well-defined rhombic crystals of a deep yellow colour, the composition of which is expressed by the formula $C_{14}H_4(NO_2)_4O_4$. Most of the salts, such as the potassium, sodium, magnesium, barium, silver, and mercury salts, are soluble in boiling water, and crystallise in lustrous needles, varying in colour from light yellow to brownish red. By reduction with tin and hydrochloric acid the nitro acid yields a dark blue powder, which is almost insoluble in alcohol, glacial acetic acid, &c., but dissolves in caustic alkalies with a fine violet colour like that of alkaline solutions of alizarin.

Diacetylanthraflavin has already been described by Perkin.* We found its melting-point to be at 227° C.

Diethylanthraflavin, $C_{14}H_6(CH_5)_2O_4$, was prepared by heating a mixture of anthraflavin, caustic soda, iodide of ethyl, and a little alcohol in sealed tubes to 120°, and crystallising the product from boiling alcohol. It crystallises in light yellow needles, which are soluble in benzol and glacial acetic acid, but insoluble in water. It fuses at 232°. The fused substance on cooling is converted into a mass of prismatic crystals. The spectrum of the solution in concentrated sulphuric acid, which is red, shows a well-defined absorption band between the green and blue.

Dimethylanthraflavin, the preparation of which is similar to that of the preceding, has almost the same properties as the ethyl compound. It fuses at 247° to 248°.

Isoanthraflavin.

This isomeride of alizarin was prepared from a by-product of the manufacture of alizarin supplied to us some time ago by Mr. Perkin, and which, according to the latter, had been obtained by treating the crude alizarin with lime-water, filtering and precipitating the red extract with acid. The product was treated with dilute caustic soda lye, in order to separate some anthraquinon. The filtrate gave with hydrochloric acid a yellow gelatinous precipitate, which was filtered off and treated with cold baryta water, until nothing more dissolved. The residue left undissolved after this treatment consisted of barium anthraflavate, and was employed for the preparation of anthraflavin. The blood-red solution was mixed with hydrochloric acid, which gave a yellow precipitate consisting of isoanthraflavin. This was purified by repeated

* *Journ. Chem. Soc.*, xxvi., p. 20.

crystallisation from boiling alcohol, and was obtained in long yellow crystalline needles. Sometimes it yielded golden yellow lustrous scales, but these on re-crystallisation always gave needles. These needles, after drying over sulphuric acid, still contain 1 molecule of water of crystallisation, which is driven off by heating to 120°. The dried substance has a composition agreeing with the formula $C_{14}H_8O_4$, five analyses giving as a mean C 69·79, H 3·65, the calculated amounts being C 70·00, H 3·33. The properties of isoanthraflavin resemble those of anthraflavin. It melts at a temperature above 330°. When slowly heated between watch-glasses it yields a sublimate consisting of lustrous bright yellow needles and plates. It is a little more soluble in boiling water than anthraflavin. It dissolves easily in boiling alcohol and in hot concentrated sulphuric acid, but is almost insoluble in benzol and chloroform. It imparts no colour whatever to mordants and differs in this respect very widely from alizarin. It may be easily distinguished from anthraflavin by the colour of its alkaline solutions, which is distinctly red, while the colour of anthraflavin solutions is deep yellow, or when concentrated reddish yellow. In concentrated sulphuric acid isoanthraflavin dissolves with a cherry-red, anthraflavin with a yellow colour. The two substances may also be readily distinguished by their behaviour towards lime and baryta water, in which isoanthraflavin dissolves easily in the cold, yielding red solutions. Anthraflavin, on the other hand, is almost insoluble in cold baryta water, and only dissolves on boiling, while in lime water it is almost insoluble at all temperatures. Isoanthraflavin in most of its properties approaches purpuroxanthin even more closely than it does to anthraflavin; but having prepared a specimen of purpuroxanthin according to Schützenberger's process, we are enabled to assert positively that the two bodies are not identical. One of the characteristic properties of purpuroxanthin is that it yields phthalic by oxidation with nitric acid, whereas isoanthraflavin gives with nitric acid a nitro-substitution product.

The barium compound of isoanthraflavin can be made to crystallise (though not without some difficulty) in dark red needles resembling barium anthraflavate. It contains water of crystallisation, which it loses on being heated to 150°. The composition of the dry salt corresponds with the formula $C_{14}H_6BaO_4$.

Tetrabromisoanthraflavin, $C_{14}H_4Br_4O_4$, is prepared in the same way as tetrabromanthraflavin. It crystallises in yellow needles, soluble in boiling alcohol and in glacial acetic acid.

Diacetylisoanthraflavin, $C_{14}H_6(C_2H_3O)_2O_4$, was obtained by the action of acetic anhydride on isoanthraflavin at 160° to 180°. It crystallises in light yellow microscopic needles, which are soluble in alcohol and more easily soluble in glacial acetic acid. At 175° it commences to soften, and at about 190° it fuses completely. It is decomposed by alcoholic potash solution.

Diethylisoanthraflavin, $C_{14}H_6(C_2H_5)_2O_4$, was prepared in the same way as diethylanthraflavin, which it closely resembles. It crystallises from alcohol in long light yellow shining needles, soluble in alcohol and ether, more soluble in glacial acetic acid and benzol. It fuses at 193° to 194°. It dissolves in concentrated sulphuric acid, forming a purple solution, the spectrum of which shows two ill-defined absorption bands, one in the yellow the other in the green.

Isoanthraflavin gives, with fuming nitric acid, a nitro-substitution product similar in its appearance and general properties to nitro-anthraflavic acid, but we have been unable from want of material to examine it minutely.

We will conclude with a few remarks on the action of caustic alkalies on anthraflavin and isoanthraflavin. On a former occasion it was stated by one of us that anthraflavin yields by the action of fusing hydrate of potash alizarin, and it was this supposed convertibility into alizarin which led Liebermann and others to the conclusion that anthraflavin was identical with monoxyanthraquinon. We are now in a position to assert with confidence that the product of the action of alkalies is not alizarin. On repeating the experiment on a larger scale by fusing the substance with caustic potash in a silver basin we obtained a substance which, after being freed from impurities crystallised from alcohol in orange-coloured needles strongly resembling, but certainly not identical with, alizarin. On heating it yields a sublimate in needles very similar to sublimed alizarin. The solution in alkalies is, however, devoid of the violet tint characteristic of alizarin, and on dilution appears distinctly red. The spectrum of the solution shows two absorption bands similar to those of alizarin solution, but these bands, according to the determination kindly undertaken for us by Dr. Schuster, lie further away from the red end than the bands of alizarin. It appears probable that this body may turn out to be an isomeride of purpurin, resembling Mr. Perkin's anthrapurpurin. Isoanthraflavin when treated in the same way yields a body which has most of the properties of anthrapurpurin, though it seems to crystallise more readily and in longer needles than the latter substance does, according to Mr. Perkin's account. We are at present engaged in the investigation of these products.

ON THE CLASSIFICATION OF THE CYANOGEN COMPOUNDS.

By SYDNEY LUPTON, M.A.

(Concluded from page 225).

According to Schorlemmer and others, when a ferric salt is added to potassium ferrocyanide a deep blue precipitate, $Cy_{12}Fe_2(Fe)_2^{VI}K_2$, is formed, which is insoluble in salt solutions, but soluble in water. On dissolving this precipitate in water, and adding a ferrous salt, a blue precipitate, $Cy_{12}Fe_2(Fe_2)Fe$, falls, which is the chief constituent of Prussian blue. Turnbull's blue is supposed, when pure, to have the same composition; the ferricyanide oxidising the ferrous to ferric salt, and being itself simultaneously reduced to ferrocyanide.

But it is stated, on the other hand, that when common Prussian blue is treated with solution of potash it breaks up with formation of potassium ferrocyanide and *ferric oxide*. When Turnbull's blue is treated in the same manner it also yields potassium ferrocyanide, but *magnetic oxide of iron*.

Cyanides of Unknown Condensation, $(Cy_n)^n$.

Cy^n, para-cyanogen.

$Cy_n(OH)_n$, cyamelide.

We have as yet no means of determining n in these cases. Jacobsen and Emmerling consider para-cyanogen to be (Cy_4). It is possible that n in each of these cases is one, the difference from cyanogen and cyanic or cyanilic acid being caused by the different modes of combination of the self-saturated affinities of the nitrogen.

We should expect from our classification to find many analogies between the cyanides composing our first class and the chlorides, bromides, and iodides: thus we have—

CyH	CyCy	CyOH	$CyCH_3$
ClH	CyCl	ClOH	$ClCH_3$
BrH	CyBr	BrOH	$BrCH_3$
IH	CyI	IOH (?)	ICH_3

While we should expect analogies between the cyanides composing our second class and the oxides, sulphides, and selenides; thus we have—

$Cy_2(OH)_2$	Cy_2S	Cy_2Cl_2 (?)	Cy_2KAg
$S(OH)_2$	SS	OCl_2	OKH
		SCl_2	SKH

We may also compare one or two other cyanides with well known oxides—Pelouze's cyanide of iron, Cy_8Fe_3, with magnetic oxide of iron; ferric cyanide, Cy_6Fe_2, with

ferric oxide; and cyanide of zinc and potassium, Cy_4ZnK_2, with oxide of lead and silver, O_2PbAg_2.

Several cases of similarity between cyanogen and chlorine may be brought forward besides those adduced by Mr. Skey.

Let us first consider the direct combination of each of the three bodies with potassium :—

$$K_2+Cy_2=2KCy$$
$$K_2+Cl_2=2KCl$$
$$K_2+2O_2=K_2O_4.$$

No one has yet been able to form K_2O by this reaction, but of course it is possible to form lower oxides than K_2O_4 at lower temperatures.

Next take the direct combination with hydrogen :—

$$H_2+Cy_2=2HCy$$
$$H_2+Cl_2=2HCl$$
$$2H_2+O_2=2H_2O.$$

In the first two cases the combination takes places without condensation, in the third case there is a condensation of one-third.

Potassium cyanide may be directly oxidised by lead oxide and hydrogen cyanate thus procured, hydrogen chloride is directly oxidised by potassium permanganate, and water may be indirectly oxidised—

$$HCy+O=CyOH$$
$$HCl+O=ClOH$$
$$H_2O+O=O_2H_2.$$

In the first two cases the oxidised body possesses *acid* properties; hydrogen dioxide is certainly not an acid.

If the three bodies, ozone being used for oxygen, be passed into a solution of potash in water—

$$Cy_2+2HKO=H_2O+KCy+KCyO$$
$$Cl_2+2HKO=H_2O+KCl+KClO$$
$$O_3+2HKO=H_2O+O_2+K_2O_2.$$

The first two reactions are evidently very similar, and differ entirely from the last one.

Let us now briefly examine the arguments which Mr. Skey brings forward in support of his views. Leaving out the acidity of prussic acid, the evidence for which is doubted by Mr. Skey, I pass to the alkalinity of potassium cyanide. This argument cuts both ways, for if KCl is neutral to litmus so is K_2O, and $HKCy_2$, the true analogue of HKO, has not yet been formed with certainty.

With regard to the cyanides and chlorides of the heavy metals, I would advance with due deference that there is a very strong similarity, though in many cases no corresponding salts are known in the other series. Thus, taking the potassio-platinum compounds, we have—

K_2PtCl_4	analogous to	K_2PtCy_4
,,	,,	$K_4Pt_2Cy_{10}$
K_2PtCl_6	,,	,,

We have as yet no chlorides analogous to the platinicyanides, but, leaving out of consideration the perhaps doubtful $BaPtCy_6$, we have $K_2PtCy_4Cl_2$, and all the other metals of the platinum group form cyanides exactly analogous to K_2PtCl_6.

Further, I quite agree with Mr. Skey that cyanic is not analogous to chloric acid, but it is analogous to hypochlorous acid. Unfortunately, our knowledge of the hypochlorites is too limited to form a satisfactory basis for an argument. We have, in the present state of our experimental knowledge, certainly no right to formulate prussic acid as Cy_2H_2: the vapour density found by Gay-Lussac was 0·947, which closely agrees with 0·9405, that required by the formula HCy.

The question of the relative solubility of the cyanides, oxides, and chlorides is too large a subject for me to enter upon at the conclusion of a long paper, but I might venture to suggest, in the first place, that such a reason is far too slight to justify us in making so important a change; and, secondly, that the evidence by no means lies entirely on the side so ably advocated by Mr. Skey. Silver cyanide, for example, is insoluble in water but soluble in potassium cyanide, zinc oxide is insoluble in water but soluble in potassium hydrate. But, on the other hand, cuprous chloride is insoluble in water but soluble in potassium or ammonium chlorides; silver chloride is insoluble in water, but soluble to a slight extent in sodium chloride.

Lastly, Mr. Skey draws a parallel between chlorine and sulpho-cyanogen, which I fear the facts of the case hardly bear out; they agree I admit in one very important particular—each is a monad, but I think the resemblance goes no further.

In conclusion, I must apologise that want of space compels me to leave out graphic formulæ and references, and venture to express a hope that another paper from the pen of Mr. Skey may help to clear away the many difficulties which still stand in the way of a satisfactory classification of the cyanogen compounds.

NOTE ON WATER ANALYSIS.

By SIDNEY W. RICH.

In the ammonia process of water analysis, when we deal with a tolerably good water, the error of observation due to the limited number of shades that may be discriminated by the eye is unnecessarily multiplied by the three or four separate comparisons of the distillates for albuminoid ammonia. Again, many waters will continue to yield ammonia until the contents of the retort have been boiled to nearly dryness; in point of fact, in such waters the organic matter is of such a kind that, although its ammonia may perhaps be eliminated by boiling with alkaline permanganate, the time allowed before the whole of the water shall have been boiled away is insufficient for such decomposition.

In the first instance mentioned above I find a very sharp reading may be obtained by concentration of the distillate, and in the second a slightly increased quantity of ammonia may be obtained by prolonged boiling, although, in nearly all cases, a definite cessation of the elimination of ammonia is at length reached. In either case I find that the object in view may be conveniently attained by returning a portion of the distillate to the contents of the retort and then re-distilling.

It has been my practice to carry the distillation out as follows :—As recommended by Wanklyn, I employ 500 c.c. of the water and distil first 50 c.c. and a further 150 c.c. for "free" ammonia; I then add the alkaline permanganate, and distil a first quantity of 50 c.c., and a further quantity of 150 c.c. The first 50 c.c. contain the larger proportion of the albuminoid ammonia, and may be at once Nesslerised; the second quantity of 150 c.c. is returned to the retort, and re-distilled until 50 c.c. have come over, which quantity is Nesslerised; the distillation is continued and the next 50 c.c. tested, but it will generally be found to contain less than one-hundredth of a milligrm. of ammonia. In very good waters which require to be compared it is useful to return the whole of the 200 c.c. of distillate to the retort after the addition of alkaline permanganate, and re-distil so as to get the whole of the albuminoid ammonia into the one quantity of 50 c.c. In very bad waters there is an advantage in the prolonged boiling, but the distillate will, in many cases, contain too much ammonia to allow of Nesslerising; it must accordingly be diluted with distilled water free from ammonia. This little modification, as I believe, of the general practice will also be found useful where circumstances render it necessary to perform the analysis on an unusually small quantity of water. In such cases I do not discriminate between "free" and "albuminoid" ammonia, but distil at once with alkaline permanganate, return the whole distillate to the retort, and re-distil 50 c.c. By this means 100 c.c. will quite suffice for an analysis; indeed it is a question whether the smaller quantity is not the better in skilful hands.

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

Preservation of Ice. By Dr. H. MEIDINGER.

(Continued from p. 225.)

IN breweries ice is still universally stored in walled pits, which are placed near the store cellars, and keep the latter cool. In Dreher's establishment the cellars occupy 113 cubic fathoms = 771·05 cubic metres, serving to store 3600 to 3800 eimer of beer = 2038 to 2151 hectolitres, and the adjoining ice pit contains 65 cubic fathoms (413·52 cubic metres) holding about 6510 cwts. of ice. (368·466 kilos.). The ice pits have the defect of being costly in construction and uncertain in their action. If ground water flows in over the floor, the ice melts rapidly. Where ice is stored up for sale in large quantities it is better to construct ice houses above ground, after the American plan, consisting essentially of double walls of wood with an interval of at least 0·3 filled with some bad conductor of heat, such as sawdust, chaff, loose peat, &c., in a dry state. Thus, the North German Ice Works at Berlin had, in 1871, an ice house 180 metres long, 24 wide, and 10 high, for the storage of 600,000 cwts. of ice. Such ice houses are cheaper than the subterranean ice pits, more convenient in use, and preserve the ice better, if only the layer of non-conducting matter is thick enough. The author† has treated this subject at length elsewhere. Every season new methods of preserving ice are announced in the papers. None of these are at all novel in principle; they depend upon causing a heap of ice to freeze together, if possible, and then covering it with a bad conductor of heat, such as straw, moss, &c. This is in the south of Germany but an unsatisfactory method; far in the north, especially in Russia, it may succeed. Such coverings, further, are very perishable. A cheap and effective ice house on a small scale can only be made in our latitude by preparing two cubic boxes, the inner measuring not less than 2 metres with an interval of at least ½ metre between it and the exterior box in every direction. This interval is not left void, but filled with chaff, chopped straw, dry spent tanner's bark. The only entrance is a door of the same thickness as the sides. According to calculation in a well-made ice house of this construction the ice scarcely melts in a year at the distance of 15 centimetres from the walls. To divide the interval between the double sides into several compartments alternately filled with a bad conductor and left empty—as occasionally recommended—is decidedly irrational, being more costly and less effective than a single well-filled broad interval. The air, though the worst conductor of heat, yet if it can move freely in a given space, rapidly transfers heat from a warmer to a colder surface. It is sometimes recommended, and even attempted, to improve a bad ice house by throwing a quantity of salt upon the ice. The author has shown‡ that this is a very irrational procedure, since, although the cold may be increased to the senses, a considerable loss of ice ensues, the access of heat to the ice pit being accelerated by the augmented difference in temperature.

The preservation of ice is not only important on the large scale, but it is of consequence on the small scale in domestic operations. Food is to be kept cold and thus preserved from decay, or ice is to be used directly for cooling purposes. For this purpose closed boxes are employed under the name of ice cupboards or ice chests. The theory of these contrivances has been examined by the author.‖ The ice closets are cupboards with double sides, the interval filled with chaff, &c., and the insides carefully lined with sheet zinc. The interval between the sides is often too small. According to the author's experiments, the entire breadth of the double side should not be less than 10 centimetres if the ice is to be preserved from rapid melting and a temperature of say 4° C. is to be maintained within. It is also preferable to place the ice in the entire upper third of the closet so that the lower two-thirds remain at liberty for food, &c. The entire cover is then made to open. The ice can then be easily taken out in pieces, and the whole lower space is equally cold, whilst if the ice is placed in a lateral compartment, as soon as it melts only the lowest part of the closet is thoroughly cooled.

(To be continued)

* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzehends."

† *Baden. Gewerbzeitung.*, 1870, 71, iv., Nos. 5 and 6.

‡ *Baden. Gewerbzeitung.*, 1868, 74.

‖ *Baden. Gewerbzeitung.*, 1868, 66, and 1869, 11 and 16.

ON THE ACTION OF MAGNESIUM ON SOME METALLIC SALTS.

By SERGIUS KERN, St. Petersburg.

SOME further experiments have been made referring to the action of magnesium on aqueous solutions of metallic salts (CHEMICAL NEWS, vol. xxxii., p. 309; vol. xxxiii., p. 112).

1. In a saturated solution of manganous chloride, after about six or eight hours, magnesium yields manganomanganic oxide. Hydrogen is freely evolved. The Mn_3O_4 is formed during this reaction as follows:—

$$3MnCl_2+3Mg+3H_2O=3MnO+3MgCl_2+3H_2.$$

But the manganous oxide is quickly oxidised by the water, and is transformed into Mn_3O_4 by the following reaction:—

$$3MnO+3H_2O=Mn_3O_4+3H_2.$$

2. A salt of uranium was also decomposed by magnesium, viz., the nitrate. In some hours the metal was covered by a yellow insoluble powder, which is formed by the reaction—

$$UrO_2 2NO_3+Mg+H_2O=UrO_2.O+Mg2NO_3+H_2.$$

Thus during this reaction uranic oxide is formed.

3. The solution of bichromate of potassium is very slowly decomposed by magnesium. The action of this metal in this case may be explained by the equation—

$$K_2Cr_2O_7+Mg+H_2O=MgCr_2O_7+K_2O+H_2.$$

But as the potassium oxide cannot exist in free state during this reaction it is quickly transformed by the water into potassium hydroxide.

4. The action of magnesium on aluminium salts is very feeble. This metal being for many days in contact with aluminium chloride yields a small amount of aluminium hydrate ($Al_2O_3H_3$). Hydrogen is slowly evolved.

5. With palladium salts magnesium evolves hydrogen freely. Palladium monoxide is formed; it was also observed that palladium is also partly precipitated in the metallic state on the magnesium. The precipitated metal was found to contain hydrogen; thus it may be supposed that a part of the hydrogen resulting from the decomposition of water combines with the palladium to form the hydrogenated palladium of Debré (Pd_2H).

6. In copper salts magnesium is rapidly covered with copper; very rapid evolution of hydrogen is observed. This reaction could be used for the detection of small quantities of copper.

7. In a solution of ammonium chloride hydrogen is evolved very rapidly, the solution becomes even frothy. A piece of magnesium weighing one centigramme was entirely destroyed in twenty-five minutes. The solution quickly turns red litmus paper blue. The reaction may be represented as follows:—

$$4NH_3HCl+2Mg+3H_2O=2MgCl_2+3NH_3O+5H_2+NH_3$$

But as the compound NH_3O (hydroxylamin) is a very

unstable compound it is quickly decomposed by the reaction :—

$$3NH_3O = NH_3 + N_2 + 3H_2O.$$

With a solution of ammonium nitrate magnesium also evolves hydrogen very freely. A piece of magnesium weighing 2 centigrammes was destroyed in two hours. The solution becomes very caustic owing to the presence of ammonia, which is formed exactly in the same manner as when magnesium acts on NH_3HCl; the only difference is that instead of magnesium chloride magnesium nitrate is formed.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, June 1st, 1876.

Professor ABEL, F.R.S., President, in the Chair.

THE minutes of the previous meeting having been confirmed, and the donations announced, the names of Messrs. T. H. Johnson, O. Hehner, G. C. Thomson, H. A. Bernays, W. J. Fuller, and G. Auerbach were read for the first time. Messrs. Robert Henry Harland, James Edmunds, M.D., Harold Holcroft, C. A. Buckmaster, Samuel Hall, Percy C. Gilchrist, and Walter Hibbert were duly elected, after their names had been read the third time.

The first paper, "*On Hemine, Hematine, and a Phosphorised Substance contained in Blood Corpuscles*," by Dr. J. L. W. THUDICHUM and Mr. C. T. KINGZETT, was read by the latter. The hemine employed was prepared by a modification of Wittich's process, and on examination was found to consist of hematine hydrochloride, mixed with free hematine and a phosphorised substance analogous to the brain myelines which gave a double salt with cadmic chloride of the composition of—

$$C_{76}H_{163}N_3P_2O_{14}(CdCl_2)_2.$$

After recapitulating Paquelin and Jolly's researches on hematine—who state that it does not contain iron—the authors give the results of their experiments made with a view to verify this statement. They find, however, that the hematine obtained in this manner, instead of being free from iron, contained as much as 9·8 per cent of the metal, the largest amount ever before found in any preparation of hematine.

The PRESIDENT having thanked the authors for their important and interesting communication,—

Prof. W. N. HARTLEY read a paper "*On the Natural Carbon Dioxide from Various Sources.*" After alluding to the examination of the liquids in the cavities of minerals made by Bryson, by Sorby and Butler, the experiments of Vogelsang and Geissler,—who proved that the cavities contained carbonic anhydride,—and his own paper on the subject read a short time ago before the Society, the author described the methods he had adopted for accurately determining the critical point of the liquid in these cavities, and also an ingenious apparatus for use on the stage of the microscope, to enable the operator to ascertain at once whether the liquid in a cavity was carbonic anhydride or not by subjecting it to a jet of heated air, a Nicol's prism being fixed under the stage to get rid of double refraction in quartz and similar crystals. The author gives a table of the critical point as determined in cavities in fifteen minerals, including topaz, sapphire, tourmaline, beryl, and rock crystal. The critical point is not the same in all, but varies slightly in several instances from that determined for pure carbonic anhydride by Andrews. These variations the author attributes to the presence of nitrogen or of hydrochloric acid, the former lowering and the latter raising the critical point. The paper concluded with some suggestions as to the probable manner in which these liquid cavities were formed.

The CHAIRMAN said that the hearty manner in which the Fellows had recorded their thanks showed how much they appreciated Mr. Hartley's valuable paper.

Mr. KINGZETT then read "*A Note on some Trials of Frankland and Armstrong's Combustion Process in Vacuo*," by Dr. Thudichum and himself. In this paper the authors give the details of several combustions made by this method, employing, however, cupric oxide prepared from the nitrate instead of that made from metallic copper. The amount of carbonic anhydride obtained did not in all cases accord very closely with that required by theory; the nitrogen determinations, however, were very good. As it is generally necessary to make a combustion by the ordinary method for determining the hydrogen along with the carbon, the authors consider that the vacuum method —especially if potassium dichromate and sodium carbonate be used as a source of carbonic anhydride to sweep out the last traces of nitrogen—surpasses all others in accuracy and simplicity for the determination of nitrogen, or as a test of the presence of that element.

Mr. FRISWELL said he had made experiments in 1871 with this process in analysing the thallium compound of the formula $Tl_2Pt(CN)_4.CO_3Tl_2$, the results of which were published in the Society's *Journal*. The chief difficulties he had had to contend with were those of extracting the last traces of nitrogen from the tube, and of weighing the very small quantities of substance to be analysed with sufficient accuracy.

Mr. W. THORP said that if, instead of employing the cupric oxide made from the nitrate, the author had used that prepared from metallic copper, as recommended by Frankland and Armstrong, he believed they would have obtained better results: he had used the process for elementary analyses some two or three dozen times, and had not experienced any difficulty. The chief objection to its general use was that pointed out by Mr. Friswell, namely, the weighing such small quantities of substance.

Mr. KINGZETT replied that he had employed about 0·020 grm. of substance in his experiments, and had found no difficulty in weighing this quantity with sufficient accuracy.

Mr. T. FAIRLEY then gave a short abstract of three communications, the first being "*On Peroxides.*" The author finds that acid solutions of hydrogen peroxide readily and quickly dissolve finely divided silver, whilst a mixture of the peroxide with hydrochloric acid also dissolves both gold and platinum. These results help to explain the action of finely divided metals on hydrogen peroxide in neutral solutions: the oxide of the metal is first formed, which, in contact with excess of hydrogen peroxide, undergoes double decomposition,—

$$Ag_2O + H_2O_2 = Ag_2 + O_2 + OH_2.$$

After some observations on the heat of formation of the oxygen molecule and of water, the author passed on to the preparation of sodium peroxide, of which he exhibited a fine specimen. It is prepared by mixing a solution of sodium hydrate (10 to 20 per cent) with hydrogen peroxide, and precipitating by alcohol, taking care that the peroxide is not in excess. The crystals have the formula $Na_2O_2.OH_2$. On mixing solutions of pure hydrogen peroxide and uranium nitrate or acetate, a yellowish white precipitate, having the empirical formula $UO_4.2OH_2$, is produced. Its rational formula, however, is three times this, $U_3O_{12}.6OH_2$, or $UO_6.2UO_3.6OH_2$, as is shown by the fact that when treated with an alkaline hydrate ordinary uranic hydrate is left, whilst a salt of peruranic acid enters into solution. The author has also succeeded in obtaining an anhydrous tetroxide, UO_4, besides salts of peruranic acid. The ammonium compound,—

$$U_2O_{10}.2NH_4.8OH_2,$$

is an orange-yellow precipitate, obtained by adding alcohol to a mixture of uranic nitrate, hydrogen peroxide, and

ammonia. The sodium salt, $UO_6,2Na_2O,8OH_2$, is precipitated in golden needles and plates on dissolving uranic hydrate or tetroxide in sodium hydrate, adding hydrogen peroxide and then a little alcohol. The potassium salt was prepared in a somewhat similar manner, but is less stable than the sodium and ammonium compounds.

The second paper was "*On Chromic and Perchromic Acids.*" The author's attempts to prepare pure salts of perchromic acid were without success: by an indirect method, however,—namely, observing how much potassium dichromate was necessary to decompose a known quantity of hydrogen peroxide acidulated with sulphuric acid,—he obtained results which suggest the formula $CrO_6.3OH_2$ for perchromic acid.

Mr. Fairley's third paper, "*On the Estimation of Nitrogen,*" gives the details of a process which combines Cloëz's method of making the combination in an iron tube with Will and Varrentrap's soda-lime process. The substance is burnt with soda-lime in a wrought-iron tube in a current of coal-gas, purified by passing it first over heated soda-lime, and then over pumice saturated with sulphuric acid. The author has obtained most satisfactory results with the process.

After the CHAIRMAN had thanked the author,—

The SECRETARY read a paper by Prof. J. W. MALLET, "*On Aluminium Nitride and the Action of Aluminium on Sodium Carbonate at a High Temperature.*" In order to ascertain if aluminium would take up carbon in the same way that iron does, a mixture of sodium carbonate with excess of metallic aluminium was very strongly heated. The desired result was not obtained, however; the product—which was a dark grey sintered mass mixed with unaltered aluminium—contained, besides carbon, small crystals of aluminium hard enough to scratch topaz. On the surface of the aluminium regulus were little crystalline patches of a yellow colour. This substance, of which the quantity was but small, was found on examination to be aluminium nitride, Al_2N_2. Acids attack it rapidly if concentrated, slowly if dilute.

The last paper, by Prof. TUSON and Mr. E. NEISON, was "*On the Estimation of Mercury.*" The method is founded on Hannay's process for the estimation of mercuric chloride, which has been extended by the authors so as to include all the salts of mercury. The addition of ammonia or an ammonium salt to an alkaline solution of the mercuric salt produces an opalescent white precipitate, which is re-dissolved on adding a standard solution of potassium cyanide, the end of the operation being very readily ascertained by the extinction of a peculiar blue opalescence that the solution previously possesses. The accuracy of the process is such that if the amount of mercury is large it can be determined to within 0·02 per cent, whilst even with a few milligrammes it can be estimated to 0·2 per cent. The paper contains an investigation of the influence of other salts on the sensitiveness of the process, and concludes with the analysis of a number of mercuric salts, including the nitrate, sulphate, acetate, citrate, oxalate, sebate, &c.

The CHAIRMAN, having thanked the author, adjourned the meeting until Thursday, June 15th, for which the following papers are announced:—1. "Chemical Studies," by Prof. Dewar. 2. "Researches on the Reduction of Nitric Acid, and on the Oxides of Nitrogen: Part I.—On the Gases Evolved by the Action of Metals on Nitric Acid," by Dr. H. E. Armstrong and Mr. Ackworth. 3. "The Composition and Formula of an Alkaloid from Jaborandi," by Mr. C. T. Kingzett. 4. "The Simultaneous Action of Iodine and Aluminium on Ether and Compound Ethers," by Dr. J. H. Gladstone and Mr. A. Tribe. 5. "On Compounds of Antimony Pentachloride with Alcohols and with Ethers," by Mr. W. C. Williams. 6. "On the Volatility of Barium, Strontium, and Calcium," by Prof. J. W. Mallet. And 7. "Note on the Action of Potassium Pyrogallate on Nitric Oxide," by Dr. W. J. Russell and Mr. Lapraich.

NOTICES OF BOOKS.

Notes on the Practical Chemistry of the Non-Metallic Elements and their Compounds. By WILLIAM PROCTER, M.D., F.C.S., Lecturer on Chemistry at St. Peter's School, York. London: Simpkin, Marshall, and Co.

ALTHOUGH the author, in his preface, states that he has found the want of a text-book on the non-metallic elements, we are at a loss to discover any special advantage possessed by the work under notice, as there appears to be little or no originality in its arrangement, and the information is merely that which is to be found in dozens of other text-books, if we except some rather startling statements which are in opposition to general experience or the accepted principles of chemistry. Thus, on page 12, we are told that "the combination of the two suffocating gases, ammonia and chlorine, produce (*sic*) the white, solid, inodorous, sal ammoniac," and the same statement is substantially repeated on page 14. On the next page it is stated that "if lead sulphide be heated, the combination between the lead and sulphur is broken up, the latter being volatilised and the former left." On page 70, a solution of cupric sulphate in ammonia is stated to dissolve carbonic oxide, and further on the formation and decomposition of phosgene gas is said to be valuable as "a test for CO *united* with other gases. The paragraph referring to phosgene is one of a section on *olefiant gas*, which gas is stated to be absorbed by cuprous chloride. It is but fair to say that the book contains a good deal of information in a small space. The formulæ are those in favour at South Kensington. At the commencement there is a sheet of very roughly executed woodcuts of apparatus.

CORRESPONDENCE.

THE CHEMICAL SOCIETY.

To the Editor of the Chemical News.

SIR,—The varied, but on the whole favourable, criticism elicited by the letters of "Twig" and myself upon this subject calls, on some points, for explanation and reply.

Both your first correspondent and Mr. Warington, who are our only adverse critics, agree in their charge against us. We are altering the aims of the Chemical Society, say they.

Now, looking at its charter, I find the object to be "the general advancement of Chemical Science." I fail to see how, when refusing unqualified candidates for admission, we at all depart from this intention.

Deny it as one may—and this is the real grievance—it is clear to all that the Society does not command respect, and I think that when the body supposed to represent Chemistry is allowed to become a bye-word and a laughing-stock it is high time to enquire whether such is the best means of promoting Chemical Science. I differ from Mr. Warington in believing that the Chemical Society was intended to be an association of chemists, and chemists alone, not a body of miscellaneous *dilettanti* —else why ballot for Fellows at all? Were it really a body of chemists it would surely forward the interests of our Society with much more ability and effect than at present, and so subserve better the purpose for which it was founded.

If it is a money matter, and these outsiders wish to subscribe to the funds, or to have the advantages offered by the Society, why not do something like that proposed by C. J. W.?—say, let them be admitted associates, receive the *Journal*, and pay double. We would not then require even to ballot for them.

I hope that in future properly qualified candidates will take care to state fully and clearly their claims to Fellow-

ship; there will then be no doubt about the result of their application.—I am, &c.,

NUNTIUS.

To the Editor of the Chemical News.

SIR,—Being one of the first of your contributors on the subject of the blackballing at the Chemical Society may I be permitted to make some additional observations.

Your correspondents "Nuntius," "Bee," "C. J. W.," and, in the main, Mr. Hartley, accord in opinion with myself. Messrs. Groves and Warington fairly represent the party of which it is sincerely to be hoped they are the last remaining shreds, and repeat the old, old story which has unfortunately so often lulled the Chemical Society when it should have been fighting the battle for which it was called into existence.

The point at issue is a very simple one. Is the Chemical Society to be an association of chemists or an assemblage of indescribables. We have been reminded that the Society exists for the advancement of chemistry. Surely this is the legitimate work of the truest chemists, and not likely to profit much in the hands of the merchant, or even the manufacturer of umbrellas? With its charter and start of thirty years the Society ought to be the one grand representative in 1876 of the chemists and chemistry of England. The Society of Analysts and the Chemical Section of the Society of Arts are, however, sad evidences of its sloth and lack of power. We want unity and vitality, and I know of no reason why all who are really engaged in chemistry, whether technological or scientific, should not acknowledge one chief, and work manfully for one common end.

As long as the Chemical Society is supposed to represent chemists—badly as it may fill this function—I shall do all that lies in my power to cause the rejection of candidates other than chemists for its Fellowship, and in so doing shall feel that I am discharging a duty which falls to the lot of all who desire the reform of the Society rather than either its annihilation or its reduction to the most ignoble of positions.—I am, &c.,

TWIG.

June, 1876.

To the Editor of the Chemical News.

SIR,—Among the five letters on this subject last week there was one containing so many misrepresentations that it calls for explanation and rebuke.

Your first correspondent, himself a younger brother, made the altogether gratuitous assumption that the recent blackballing at the Chemical Society was due to a "clique" of five or six young men. Now, those acquainted with the matter will know that this is no sudden outburst, but that for more than twelve months past a feeling of distrust has gradually been becoming more and more evident, by the increasing number of candidates refused. These chimerical "five or six young men" must verily have been winning the support of more mature heads.

Again: we are to accept the signatures of the President and senior Professors. But if they do *not* require "a strictly chemical qualification," how can we, who do, trust their signatures who don't? Certainly Prof. Abel admitted that it was thought by the Council that *dilettanti* (his very word) chemists, and even persons taking only a general interest in chemistry, ought to be elected. How, then, can your correspondent think that *their* model of candidate is to be thought suitable according to *our* standard?

Allow me to direct attention again to the excellent letter of Nuntius, who, so far from requiring a close professional society only, asks for evidence of chemical attainments, and chemical attainments only. As "Twig" also observes, one who offers any non-chemical recommendation—even be it "Merchant,"* under the heading "Qualification"—on his certificate, certainly insults the Society, and ought to be rejected even though a thorough chemist; we may ask, Why did n't he say so? How are we to know it?

In conclusion I hope, Sir, that the Chemical Society will soon again see the day when it shall be respectable and respected.—I am, &c.,

VINDEX.

Liverpool, June 6, 1876.

To the Editor of the Chemical News.

SIR,—I am looking at the discussion going forward in your columns, respecting the exercise of the Ballot at the Chemical Society, with great interest. Whether the six or eight young men spoken of by Mr. Chas. E. Groves are exercising their privilege with "more zeal than discretion" I do not know; but it is certain that had a little more zeal or discretion been used for some years past, the honour—if it is one—which the Chemical Society bestows would not now be held in the contempt it is.

Mr. Warington says, "These societies do not seek to advance Science by exercising the function of an examining body." I contend that practically they do, and that any person carrying the F.C.S. has a right to claim to be a chemist, and that the Chemical Society has endorsed and stood sponsor for his claim. It is useless to deny that the world looks upon these titles which societies grant as a species of degree, and that their possession is a guarantee of the holder's proficiency in some branch of Science,—in the case of the Chemical Society, of chemistry,—and not simply a "genuine interest in these sciences." In these days a sufficient number of small local societies exist into which these genuine interest men can gain admission, and which possess sufficient scope for their small scientific maundering, and in which they can disport themselves at will. My own case will probably be that of many chemists in this country. I have been in the actual practice of chemistry, both laboratory work and manufacturing, for the last twenty-five years; have published at least a dozen papers on analytical and kindred chemical subjects; possess no degree of any kind; would have offered myself for admission to the Chemical Society years ago, but was deterred by the fact that their title indicated nothing as to attainments, but had been distributed right and left with so lavish a hand as to become a bye-word; that the learned knew how valueless it was; and that, in many cases, it served only to gratify the vanity of would-be scientific men, with which they tickled the groundlings, or, if a deeper deep could exist, was bought for advertising purposes. I hope this agitation will be continued until the F.C.S. shall mean something of definite value,—something worthy of honourable ambition,—alike worthy to be held and worthy of the society which grants it. It will probably be long, if ever, before it becomes so valuable as the title the Royal Society can confer; but it may be made one which can be worn without shamefacedness, and having to be apologised for because nothing better can be obtained.—I am, &c.,

P. H.

Manchester, June 5, 1876.

To the Editor of the Chemical News.

SIR,—Not having yet seen the last number of your journal I may perhaps repeat ideas already broached, in venturing a few remarks on election to the Chemical Society. If so, I trust I may be excused.

It must be an object with all of us to keep up the *status* of the Society. At the same time we must remember that funds are required for its work, and especially for the publication of its most valuable *Journal*, and that to this end a large number of subscribers are necessary.

The first of these objects might perhaps be attained, and the research work of the Society increased, if it were

* *Vide* letter of Mr. Warington.

made a necessary condition of election that the candidate should first contribute a satisfactory paper to the Society. This would not seem an unreasonable requirement in a Society of which the first object is the encouragement of original research; and while such a restriction might at first diminish the number of candidates, it would much augment the value of the Fellowship.

It might also help the funds of the Society, and gracefully recognise those who desired to advance its objects, if the title of Associate could be given to those who paid perhaps a rather lower subscription and did not undertake original research. These might fairly receive the *Journal*, and have the right of personal admission to all the meetings of the Society, without that of introducing others.—I am, &c.,

A Fellow.

ORGANISATION AMONGST CHEMISTS.

To the Editor of the Chemical News.

Sir,—Many of your readers will be glad to know that the proposal to establish an Institute of Professional Chemists is assuming a definite form, a scheme for the establishment of the Institute having been already prepared in readiness to be submitted to the Organisation Committee already appointed if the Council of the Chemical Society come to a decision upon the questions now before them affecting that Institute adverse thereto.

Some gentlemen, well known chemists, for whom I am professionally concerned, and who take a great interest in the establishment of the Institute, desiring that the proposed scheme should be brought under the notice of all members of the profession before the Institute is actually formed, have instructed me to address to you this communication as the only means of reaching all persons interested in this important subject.

After consideration my clients advise that the following scheme, with such amendments or additions as may be considered necessary, should be adopted, viz.:—

1. The Institute should be called the Institute of Professional Chemists.

2. Its objects should be—

(1.) For the general advancement of technical chemistry in its application to the arts, manufacture, agriculture, and public health.

(2.) To ensure that persons adopting the profession of consulting chemists or analytical chemists for reward are qualified by study and training for the proper and competent discharge of the duties they undertake.

3. Persons eligible for membership to give evidence of the possession of one or more of the undermentioned qualifications, viz.:—

As to persons now employed as chemists—

He should (if a British subject and permanently resident in Great Britain or Ireland) be a Fellow of the Chemical Society, and he should have practised on his own account in the profession of a consulting or analytical chemist, or have been employed at some recognised University, College, or Medical School as a professor or demonstrator of practical chemistry for at least five years.

As to persons not now employed as chemists—

(1.) He must be more than 25 years of age, must have passed through a satisfactory course of at least three years daily study of theoretical and analytical chemistry and physics, and have had subsequent employment for at least three years in some or one of the following manners, viz.:—In responsible situations as Assistant to a Member or Members of the Institute, or as Chemist in a Chemical Manufactory, or he must have been employed to the satisfaction of the Council for a period of at least three years in the active prosecution of original chemical research.

Or,

(2.) He must have passed such an examination or examinations in theoretical and analytical chemistry and physics as the Council may direct, such examinations to be conducted by examiners to be appointed by the Council, and he must produce such other evidence as the Council may require of qualifications and general fitness for the work and duties of a professional chemist.

All persons proposing to become Members (except persons complying with the provisions of sub-section 2, who are to be entitled to membership without election) to be elected by ballot after due notice given to every Member of proposal and candidate's qualifications for membership. All Members to be at liberty to describe themselves in certificates of analysis, &c., as "Members of the Institute of Professional Chemists," or to adopt such abbreviated form as may hereafter be decided upon.

4. The officers of the Institute to be a President, two Vice-Presidents (of whom one shall be the retiring President in those years when the President is not re-elected), a Treasurer, and two Secretaries. All these to be ex officio Members of the Council. All officers to be elected annually, but to be eligible for re-election, except as to the President, who shall not be eligible for election for more than two successive years. The Council to consist of thirty-six persons (including the six above-mentioned ex officio members), five Members of the Council to be nominated by the Council of the Chemical Society. The other Members of Council to be elected by Members of the Institute. One-third of the Council to retire each year, but to be eligible for re-election. Three Members may recommend any person for election to the Council, and a list of 50 names at least of persons eligible for election to be prepared by Council and forwarded to each Member one month before time fixed for election.

5. Power to be reserved of expelling Members in cases where ten or more Members in writing signed by them and delivered to the Secretary shall require such expulsion, and the Council, having enquired into the matter and sought explanations from the person charged, find good reason for the proposed expulsion, the Secretary to send a letter to the person proposed to be expelled requesting him to withdraw from Institute. If this advice is followed no entry beyond the fact of the Member in question having resigned his membership to be made on minutes nor any public discussion allowed; but if advice is not followed nor satisfactory explanation given, Council to summon special general meeting for the purpose of voting by ballot upon the question of proposed expulsion.

6. Quarterly or more frequent meetings of the Institute at discretion of Council to be held when papers to be read, discussions, &c., to be allowed.

7. An entrance fee of £5 5s. to be paid by persons joining during the first three months of the Society's existence. Afterwards the admission fee to be £10 10s., with an annual subscription in both cases of £2 2s. Where examination requisite a special fee of £10 10s. to be paid by each candidate. The whole income and property of the Institute to be used in promoting the interests thereof.

The above is a short statement of some of the provisions of the scheme for the organisation of an Institute which, if earnestly supported and judiciously managed, will advance alike the interests of its Members as well as the science to which they devote their talents and life. It is thought that when the name of the Institute and the high qualifications demanded from all persons seeking its membership are known the Institute will carry with it a reputation which will reflect honour upon its Members and will constitute membership a prize to be coveted and a necessity for professional success.

There are several plans of organising a society of this character, and the plan to be recommended to their *confreres* has been carefully considered by my clients who are amongst the most active of the many promoters of this enterprise. The several methods of organising the Institute may thus be briefly stated.

1. By special Act of Parliament or Charter.
2. By Deed of Settlement.
3. By Incorporation under Section 23 of the Companies' Act, 1867.
4. By the publication of Rules and Regulations to be signed by every Member upon his admission as a Member.

Under one of the methods stated in the first and third cases alone can the Institute become a Corporation, but as the Government would not at the present time grant a Charter or support an application for a special Act of Parliament for the Incorporation of the Institute, the only course open to the promoters is to register the Institute as a Joint Stock Company in accordance with the Companies' Act, 1867, or to form a Society with or without a Deed of Settlement, which would be in its nature a purely voluntary Society without legal existence and having none of the incidents of a corporate body. After mature reflection my clients think it better that the powers given to them by the Companies' Act should be employed.

For the information of such of your readers as may not be acquainted with the provision of the section of the Act to which reference is made, I may remark that thereby, where any association is formed as a limited company, if it proves to the Board of Trade that it is formed for the purpose of promoting art, science, commerce, religion, charity, or any other useful object, and that it is the intention to apply the profits or other income of the association in promoting its objects and to prohibit the payment of any dividend to the members of the association, the Board of Trade may by license direct such association to be registered with limited liability without the addition of the word limited to its name, and upon registration the association enjoys all the privileges and is subject to the obligations imposed upon limited companies, but it is not required to use the word limited as any part of its name, or to publish its name, or to send a list of its members, directors, or managers to the Registrar of Joint Stock Companies.

Several advantages would accrue from the Institute being incorporated under this statute, but it is obvious to my clients that objections may be raised thereto, and their desire is that all persons interested with themselves in this subject should have an opportunity of considering this matter before they are called upon in public meeting to decide upon the form in which the Institute is to be organised.—I am, &c.,

J. Pettengill.

32, Walbrook, London, June 7, 1876.

NEUTRAL PHOSPHATE OF SODA UNSTABLE IN SOLUTION.

To the Editor of the Chemical News.

Sir,—During the evaporation of phosphate of soda I was surprised to observe that the roof and rafters immediately above the evaporating pans became slowly coated with a fine white dust, which, after a few months accumulated to a considerable extent. This dust was sampled and analysed, and found to be neutral phosphate of soda which had slowly volatilised with the steam during the concentration of the liquor. This salt was understood to be stable when in solution, and it is a curious circumstance that it should behave in same manner as boracic acid, though in a smaller degree when the latter is evaporated in solution.—I am, &c.,

J. B. Readman.

175, Buchanan Street, Glasgow, May 31, 1876.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances, de l'Academie des Sciences. No. 20, May 15, 1876.

Theoretical and Experimental Determinations of the Relation of Two Specific Heats in Perfect Gases whose Molecules are Monatomic.—M. Y. von Villarceau.—Not adapted for abstraction.

Determination of the Temperature of Solidification of Liquids, and, in particular, of Sulphur.—M. D. Gernez.—The author remarks that the slowness with which a body melts in a bath of a constant temperature little above its point of fusion, and the imperfect conductibility of the substances, which enables certain portions of the liquid to reach temperatures higher than those of the part not yet melted, have induced experimentalists, instead of the point of fusion, to determine the point of solidification, *supposed* to be identical, in which case, however, the results obtained may be often falsified in consequence of phenomena of surfusion. Sulphur insoluble in the bisulphide of carbon, as obtained by exhausting the flowers of sulphur, solidifies at 114·3°, whatever the temperature at which it has been melted. In octohedric sulphur the point of solidification is highest when it has been melted at the lowest possible temperature. Prismatic sulphur behaves like insoluble sulphur if obtained from it, but if subjected to repeated fusions and solidifications its congealing-point may be raised more than a degree.

Calorific Spectra.—M. Aymonnet.—Incapable of useful abridgment.

Presence of Selenium in Silver.—M. H. Debray.—Silver even containing 99·8 to 99·9 per cent of the pure metal is sometimes found not adapted for the preparation of industrial alloys—a circumstance due to the presence of traces of selenium. Refiners should therefore be careful to employ only such sulphuric acid as is free from selenium. The impurity may be eliminated by melting the silver as precipitated by copper along with nitrate of potash or soda.

Chemical Researches on Vegetation; Functions of Leaves; Origin of the Carbon.—M. B. Corenwinder.—The leaves of plants do not merely acquire carbon by their surfaces, but they also assimilate carbon from the carbonic acid which circulates in their tissues.

Crystalline System of Various Bodies presenting Optical Anomalies; Theory of Crystalline Groups; Explanation of Dimorphism.—M. E. Mallard.—Reserved for insertion in full.

New Mineral from the Pyrenees.—M. E. Bertrand.—The new mineral, for which the author proposes the name of Friedelite, occurs in the manganese mines of Adervielle, in the valley of Louron, and is a hydrated silicate of the protoxide of manganese. It composition is—

Silica	36·12
Protoxide of manganese	53·05
Magnesia and lime	2·96
Water	7·87
	100·00

Antiseptic Properties of Borax.—M. Bedoin.—The author maintains that borax will be most precious in the treatment of virulent bacterial affections, and for disinfecting unhealthy localities.

Moniteur Scientifique, du Dr. Quesneville, April, 1876.

Recent Progress in the Industry of Aniline-Black.—A. Guyard.—This paper has been already noticed under

the *Bull. de la Soc. Chim. de Paris*. There is here, however, an appendix on the claims of the late Mr. John Lightfoot which was not found in the *Bulletin*, and which may be found interesting:—"Dr. Quesneville has called my attention to the question of priority raised in the CHEMICAL NEWS on the subject of aniline-black with vanadium, on which I think I ought to say a few words. Mr. James Higgin, of Manchester, writes to the CHEMICAL NEWS that, without discussing the question as to whether M. Pinkney has or has not discovered vanadium aniline-black, he must recall the fact that John Lightfoot, the inventor of aniline-black, has pointed out this reaction, and insisted that vanadium is the metal most proper to develop aniline-blacks. All this is perfectly correct, and is found distinctly expressed in an article by John Lightfoot, publishd in the *Moniteur Scientifique*, 362 livraison, February, 1872, p. 169. I will add merely that till lately we had no clear notions concerning aniline-black, and were ignorant of the part played by metals in its formation. Thus Lightfoot first, and then Pinkney, recommend the use of uranium, whose salts only produce aniline-black when they contain traces of vanadium, as I have pointed out, or when they are in the lowest stage of oxidation. On the other hand, Lightfoot states that cerium, molybdenum, and tungsten do not produce black. But cerium contributes to the formation of excellent blacks, and I have found that the salts of molybenum and tungsten at the lowest stage of oxidation are intermediate between vanadium and copper, and produce splendid blacks."

Electrolytic Aniline-Black.—M. F. Goppelsroeder.—Already noticed.

May, 1876.

Researches on Viscous Fermentation.—M. A. Commaille.—Not suitable for abstraction.

Use of Sulphide of Sodium in Tanning.—Wilhelm Eitner.—Sulphide of sodium has been employed with great success in removing the hair from hides.

Historical and Chemical Study on the Manufacture of Turkey-Reds.—M. T. Chateau.—A continuation of the treatise already noticed.

Gazzetta Chimica Italiana.
Anno vi., 1876, Fasc. iii.

Two Benzol-Bisulphuric Acids, and their Relation with other Compounds.—W. Kœrner and G. Monselise.—The author names these two acids respectively α-benzol-bisulphuric acid, corresponding to isophthalic acid, and β-benzol-bisulphuric acid, corresponding to terephthalic acid. He describes the potash, the baryta, lead, copper, cadmium, and soda salts of the former; also α-bicyanobenzin, and the chloride and amide of α-benzol-bisulphuric acid. Under the second he mentions the corresponding compounds.

Constitution of Veratric Acid and Veratrol.—G. Kœrner.—A paper devoted chiefly to hypotheses.

Santonic Ether.—F. Sestini.—The author ascribes to this compound the formula $C_{15}H_{19}(C_2H_5)O_4$.

An Addition-Product of Chloride of Acetyl and of Acetaldehyd.—R. Schiff.—This paper consists of complicated formulæ and of references to the views of Geuther.

A Chemico-Toxicological Study on Atropin.—F. Selmi.—An exhaustive examination of the reactions of atropin.

MISCELLANEOUS.

The Loan Collection of Scientific Instruments.—On Saturday evening last a large audience assembled in the Conference Room to hear Professor Roscoe's Lecture on "Dalton's Instruments and what he did with them." Dr. Roscoe pointed out that a mind like Dalton's obtained important results with rude and unimportant apparatus. His first rain guage was a wine bottle with a tin funnel 7 inches in diameter. His mercurial trough was an old halfpenny earthenware cup. His weights were made of sheet lead, which on being tested before being sent to the Exhibition were found to be fairly accurate. The law of chemical combination in multiple proportion, the experiments on the diffusion of gases, the luminosity of flame, and other important researches of Dalton's were all clearly explained by Dr. Roscoe. Prof. Guthrie, F.R.S., will lecture to-morrow evening at 8 o'clock on "Cold," and on Monday evening the Rev. S. J. Perry, F.R.S., will lecture on "Methods Employed and Results Obtained by the late Transit of Venus Expedition." The following gentlemen have also kindly undertaken to give lectures:—Prof. F. A. Abel, F.R.S.; Capt. Abney, R.E., F.R.S.; Dr. Warren De la Rue, F.R.S.; Prof. G. C. Foster, F.R.S.; Dr. J. H. Gladstone, F.R.S.; Mr. J. Baillie Hamilton; Mr. J. Norman Lockyer, F.R.S.; Rev. R. Main, M.A., F.R.S.; the Right Hon. Lyon Playfair, C.B., M.P., F.R.S.; Mr. W. H. Preece; The Earl of Rosse, F.R.S.; The Lord Rayleigh, F.R.S.; Dr. W. J. Russell, F.R.S.; Mr. W. C. Roberts, F.R.S.; Dr. W. H. Stone; Mr. W. Spottiswoode, M.A., F.R.S.; and Mr. C. V. Walker, F.R.S. Demonstrations will also be given on Saturday, Monday, and Tuesday, next as follows:—11 a.m. Marine engines in motion, Room D. 11.30, Fog-horns, Room E. Electric light, Room F. Spectrum of electric light, Room F. 12.45, Time-gun apparatus, Room K. 1.30, Radiometers, Room Q. 2.0, Pictet's ice making machine, Room F. 2.30, Orreries, Room L. 3 p.m. (Monday only), Sir J. Whitworth's millionth measuring machine and true planes, Room H. 3.30, Electric light, Room F. Musical instruments (Monday only), Room Q. Ancient musical instruments (Tuesday only), Room Q. 4.40, the *Times* composing machines, Room F.

Bunge's Chemical Balance.—One of the principal features of this balance is its short beam, which is of the form of a right-angled triangle. The portions which represent the sides of the triangle act as trusses to the main portion of the beam, which represents the triangle's base; this construction, together with the tough material employed for the trusses, namely, aluminium bronze, combines great rigidity with the least possible weight; it is capable of carrying a heavy load without appreciable flexure. The knife edges and bearings are of Rock Crystal. The edges touch the planes on a very long line, by which means great durability is obtained, and an adjustment is provided which precludes any deviation from perfect parallelism of the knife edges, and which is a means of obtaining maximum sensitiveness. For weighing by means of riders a divided scale, attached to the beam, is projected in front so as to be easily seen, and to permit of the placing of riders on any division of the divided scale by means of one sliding arm, which works from the right hand side, and takes the whole range of the beam from one end to the other; this arm lifts off the riders vertically, and its action is facilitated by a counterpoise, which carries it out of the way of the beam when it is let go. The mechanism for putting the beam in and out of action is efficient:—By turning a crank handle (on the left of the base) with a forward movement, the supports under the pans are lowered, and by limited reversal of the movement of the handle, the pans can be quieted without otherwise interfering with the balance; on turning the crank further forward, in continuance of the initial movement, a bearing, on which the pans hang when out of action, is lowered, and in its descent places the pan-suspensions upon the terminal knife edges of the beam; a still further movement of the crank puts the balance in complete action by raising the central axial bearing. Messrs. Mawson and Swan are the English agents.

THE CHEMICAL NEWS.

Vol. XXXII. No. 864.

ON THE PROCESS OF COMBUSTION WHICH TAKES PLACE IN THE INTERIOR OF CERTAIN POROUS FILTERS.

Part I.

By J. ALFRED WANKLYN,
Corresponding Member of the Royal Bavarian Academy of Sciences.

In the year 1867, almost the first observation made by the discoverers of the ammonia process of water analysis, when they came to apply the process to the examination of natural waters, related to the exceeding purity of deep spring water.

This observation, together with the remarkable purification effected by the Thames Companies when they filter Thames water through sand filters, led me, in the year 1872, to make a further investigation into the changes which take place when water is filtered through a considerable stratum of porous material. This investigation was published, in an incomplete form, in the *British Medical Journal*. The subject has a general aspect full of interest, and not unworthy of the notice of chemists. I shall, therefore, on this occasion publish my results obtained in the year 1872, and hope shortly, on a future occasion, to publish the further results of the investigation with which I am at present occupied.

Platinum black, as is well known, possesses the property of causing combustible gases and vapours to combine with oxygen. Sometimes this combination is rapid, and accompanied with incandescence; and at other times it is slow, and unaccompanied with incandescence.

I have observed a very analogous phenomenon in the action of the peculiar material used by the Silicated Carbon Filter Company.

This material possesses in a high degree the property of causing the oxygen dissolved by the water to combine with organic nitrogenous matter when the latter is in very dilute solution.

The following experiment may be cited in illustration:—

Some of the Southwark and Vauxhall water was submitted to analysis, and gave—

	Parts per million.
Free ammonia	0·02
Albuminoid ammonia	0·14

showing that at that rate this water was almost devoid of ammonia, but considerably charged with complex nitrogenous organic matter.

The water was quickly filtered once through a cake of "silicated carbon" about 4 inches in thickness. The filtrate contained—

	Parts per million.
Free ammonia	0·16
Albuminoid ammonia	0·04

The filtrate was passed three times through the filter, and then it contained—

	Parts per million.
Free ammonia	0·14
Albuminoid ammonia	0·01

With dilute solutions of urine and of milk a similar result — viz., destruction of "complex nitrogenous organic matter," and formation of ammonia as a product of the destruction—was observed.

The rate of filtration (and of consequent destruction) was very rapid. I found that 225 c.c. of water passed through the small filter in one minute.

Thus it will be seen that passage through a "silicated carbon filter," and boiling with potash and permanganate of potash, have the same effect upon a dilute solution of complex nitrogenous organic matter: both operations decompose complex nitrogenous organic matter, and both operations generate ammonia.

ANALYSIS OF PEROXIDE OF MANGANESE.

By Dr. T. L. PHIPSON, F.C.S.

The following is the composition of a sample of peroxide of manganese, largely used both for laboratory purposes and in the arts:—

Water	2·02
Peroxide of manganese	72·17
Manganic oxide	6·20
Ferric oxide	3·66
Alumina	0·90
Yttria	0·10
Baryta	0·58
Lime	4·01
Magnesia	0·24
Oxide of lead	0·14
„ bismuth	trace
„ copper	0·09
„ nickel	0·04
„ cobalt	trace
„ zinc	trace
„ thallium	0·01
„ indium	distinct trace
Arsenic acid	0·15
Phosphoric acid	0·35
Carbonic acid	3·20
Potassa	0·70
Lithia	trace
Silica and rock	4·00
Loss, including fluorine	1·44
	100·00

The quantity of MnO_2 being calculated in the usual manner, the rest of the Mn was considered as Mn_2O_3, though there are doubtless small quantities as MnO either as carbonate or phosphate. The presence of so notable an amount of phosphoric acid is remarkable. The yttria was found on adding sulphide of ammonium to the filtered liquid of the carbonates precipitated by a mixture of carbonate of soda and ammonia. Nothing was obtained at first, but after twenty-four hours there was a gelatinous precipitate, soluble in HCl, precipitated by ammonia, insoluble in an excess, insoluble in potash, precipitated by oxalic acid, soluble in an excess warm, giving no particular colour with CoCl before the blowpipe, &c. This substance had all the characters of yttria, and exists here probably as phosphate. To separate the arsenic, lead, &c., it is necessary to allow the acid liquid saturated with HS to remain at least twenty-four hours, otherwise these substances escape, more or less. The gangue contains a little *rhodonite* (red silicate of manganese), quartz, silicates, and some sulphate of baryta.

London, June 8, 1876.

ON THE ACTION OF SULPHOCYANIDES ON SODIO-GOLD CHLORIDES.

By SERGIUS KERN, St. Petersburg.

By adding to an aqueous solution of potassium sodium or ammonium sulphocyanides a solution of sodio-gold chloride ($NaAuCl_4$) a light orange-red precipitate is obtained, which easily dissolves in the liquid, giving a colourless solution. This reaction was proposed by me as a test for gold (Chemical News, vol. xxxii., p. 171).

The orange-red precipitate is a sodio-gold sulpho-

cyanide; the presence of gold in solutions of this salt is easily detected, proving the instability of this double salt. The salt is obtained by adding to a solution of sodio-gold chloride an alkaline sulphocyanide—

$$NaAuCl_4 + 4RCyS = NaAu(CyS)_4 + 4RCl.$$

In this equation R represents the alkaline metal.

A solution of $NaAu(CyS)_4$ with sodium hyposulphite gives no precipitate; barium chloride produces a milky turbidity; mercuric chloride gives a white precipitate, which quickly blackens. A very peculiar reaction occurs with calcium oxide (CaO); if a small quantity of $NaAu(CyS)_4$ is boiled for some time with CaO and water in a test-tube a blue precipitate is obtained.

It must be remarked that alkaline sulphocyanides give with ferrous salts a red colouration (Fe_3CyS), and as very diluted solutions of sodio-gold chloride also give with sulphocyanides, instead of an orange-red precipitate, only a red colouration, these two reactions may mislead analysts during analyses. The only difference between these two reactions is that red solutions containing a double gold sulphocyanide on being gently heated turn colourless, while the red solution due to the presence of e_3CyS on being boiled does not change its colour.

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 236.)

Chlorine, Bromine, Iodine, and Fluorine.

By Dr. E. Mylius, of Ludwigshafen.

The application of the three closely allied halogens, chlorine, bromine, and iodine in the chemical arts depends entirely on the energy with which they combine with electro-positive elements, more especially with hydrogen. In this respect chlorine enjoys the pre-eminence. Its most extensive application in the free state is, therefore, as a bleaching and disinfecting agent. Its efficacy depends here essentially on its remarkable affinity for hydrogen, which, under certain circumstances, even exceeds that of oxygen. Its more energetic affinities, in comparison with bromine and iodine, render it a convenient agent for obtaining the two latter. In fact the preparation of free bromine and iodine depends mainly on the decomposition of their hydrides by chlorine. A further chemical attribute of chlorine is its tendency to form with most metals soluble compounds. This behaviour is the more readily utilised, since hydrochloric acid, which may be regarded as an industrial by-product, affords a very cheap means of obtaining soluble chlorides of almost all the metals. Free chlorine is also employed as a solvent, *e.g.*, for separating and refining the precious metals, with the exception of silver.

Bromine and iodine are valuable to the chemist not so much on account of their energetic affinities as by the feeble power with which they maintain their position when combined with electro-positive elements. This weaker affinity plays a part, as already mentioned, in their production, and is at the same time the foundation of their uses. Photography, in particular, is based upon the instability of the bromide, iodide (and chloride) of silver; scientific chemistry and tinctorial chemistry utilise it extensively on account of the readiness with which bromides and iodides of the hydrocarbons and of the metals are mutually decomposed.

Of less importance to the chemist is the property of bromine and iodine—like many of the rarer elements—of exercising a perturbing action upon the healthy animal organism. The physician employs them, therefore, chiefly in combination with the alkaline metals, as valuable remedies.

Fluorine holds a distinct position from the remaining halogens, both in scientific chemistry and in technology. It is endowed with such powerful affinities as to be scarcely known in the free state, whence its energies, as a general rule, do not admit of application. Its affinity for silicium is alone utilised, hydrofluoric acid being employed for the decomposition of silicates, etching on glass, &c.

Chlorine and its Compounds.

Hydrochloric Acid.—As the initial point for the entire production of free chlorine and its compounds we still employ hydrochloric acid, which is obtained in the largest quantity as a by-product in the manufacture of alkali on Leblanc's process. The amount of hydrochloric acid liberated in this process is so enormous that if it were entirely converted into the transportable liquid acid the supply would far exceed the consumption, greatly as this has been recently extended. Hence, especially in England, little pains had been taken for the perfect condensation of the acid gas, so that vast quantities escaped into the air, and, becoming dissolved in atmospheric water, returned as rain in the neighbourhood of the works and effected manifold damage, giving thus rise to well-founded complaints on the part of the owners of the adjacent land. This rendered in England a law necessary known as the "Alkali Act" prohibiting the escape of more than 5 per cent of the total hydrochloric acid evolved. In consequence the soda manufacturers were compelled to pay increased attention to the condensation of the hydrochloric acid. The arrangements for this purpose have been improved, not only in England, but the question has been zealously taken up in France and Germany. The inducement was, on the one hand, the growing consumption of the acid and its consequent increasing value, and on the other, a wish to anticipate the complaints of the neighbouring residents and thus escape a law similar to that of England, the operation of which occasions the manufacturers decided inconvenience. In future it will be still more necessary to condense the hydrochloric acid due to Leblanc's process, as far as possible, if, as is probable, the manufacture of soda on the "ammonia" process should become more general.

Whilst formerly it was deemed sufficient to make use of the well-known *bombonnes* (groups of Woolf's bottles on a large scale) in which the gases escaping from the pan were absorbed, the method of coke-towers has become latterly universal, which enables the diluted gases to be arrested as they escape from the calcining furnace. This is greatly facilitated by the increasing use of muffle-furnaces instead of reverberatories.

The conditions to be observed in order to obtain the most perfect possible condensation of the hydrochloric acid gas, as ascertained by the exhaustive researches of E. Kopp,* G. Lunge,† and A. Smith, are as follows:—

A sufficient cooling of the gases before entering the absorbing apparatus, a sufficient volume of water, the largest possible surface of contact between the water and the gas, and the simplest possible construction of the apparatus for condensation.

(To be continued)

* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzenends."

NOTE ON SULPHUR AS A MORDANT.

By ISIDOR WALZ, PH.D., and CHAS. M. STILWELL, A.M.

Chas. Lauth has recently published the contents of a sealed package, which he deposited in June, 1872, with the Société Industrielle de Mulhouse, and in which he announces the very interesting discovery that finely divided sulphur, in the form in which it is precipitated by acids

* E. Kopp, *Moniteur Scientifique*, 1866, p. 611.

† G. Lunge, *Dingl. Pol. Journ.*, clxxxviii., 322.

from solutions of hyposulphites, forms an excellent mordant for methyl green. The wool is mordanted with three grammes sodium hyposulphite and two grammes sulphuric acid, dissolved in six hundred grammes of water, and dyed in a bath containing 0·2 gramme methyl green, 0·6 gramme zinc acetate, 0·6 gramme sodium hyposulphite, and six hundred grammes water. To obtain a yellowish shade, 0·07 gramme picric acid may be added. The zinc acetate is used in order to counteract the effect of the sulphur mordant, which makes the wool soft and shrinking. A committee appointed by the Society, and consisting of Messrs. Schaeffer and Vaucher, was charged with the examination of the matter, and their report confirms the observations of M. Lauth.

It seemed to us interesting to determine whether sulphur would act in a similar manner with other dye-stuffs, and we selected eosine for the experiment. Some sodium hyposulphite was added to an aqueous solution of eosine in a test-tube, and after addition of a few drops of hydrochloric acid, the liquid was *neutralised* with ammonia. After standing a short time, a veritable lake of sulphur and eosine settled to the bottom as a rosy-pink precipitate. We next dyed a piece of woollen fabric, following the directions of M. Lauth as above, only substituting eosine for methyl green, and omitting the acetate of zinc. The result again showed that sulphur acts as a mordant for eosine, and the resulting shade is somewhat different to that obtained by omitting the sulphur, as shown by a simultaneous dyeing test.

This result induced us to test the behaviour of wool, mordanted with sulphur, towards madder. The bath was prepared in this and subsequent experiments in the proportions already described, only the dye-stuffs being changed, and the zinc acetate omitted. A "swatch" from the same piece, but not mordanted, was placed in the dye-bath at the same time, in order to facilitate comparisons.

In the bath prepared with French extract of madder, the mordanted wool took a full reddish-brown shade, while the non-mordanted cloth was but lightly stained. To decide whether this colour was due to the alizarin or to purpurin, samples of mordanted and clean wool were treated in baths mounted with artificial alizarin on the one hand, and with commercial purpurin on the other.

The samples from the alizarin bath were alike, and dyed a good yellow; those from the purpurin bath showed a light reddish-brown, the colour of the mordanted sample being deeper than the other. We, therefore, conclude that sulphur does not act as a mordant toward alizarin, but does act in that manner towards purpurin or the other colouring principles of madder.

We extended our experiments to cochineal, logwood, redwood, and fustic; but in the case of these dye-stuffs we discovered no difference between the colours produced on ordinary and sulphur-mordanted wool. — *American Chemist.*

ON THE ESTIMATION OF TANNIN, BY MUNTZ AND RAMSPACHER'S METHOD.*

By H. R. PROCTER.

As the estimation of tannin is a matter of great commercial importance, and also, chemically, one of extreme difficulty, and the methods in use are very imperfect, I venture to lay before the Society a short statement of some results which I have obtained, rather than delay to another session in order to render them more complete.

As is well known, the method named consists in forcing the liquid to be examined through a piece of raw hide by means of atmospheric or other pressure. Equal parts of the original and filtered liquor are then evaporated and the residues weighed, or the tannin is calculated from the difference of specific gravities, it being assumed that the tannin and nothing else is removed by the hide filter. In support of this assumption, Messrs. Müntz and Ramspacher quote certain experiments in which solutions of gum, sugar, &c., were passed through the hide with but trifling loss. A solution of gallic acid, however, seems to have lost about 20 per cent, and the experimenters remark that the hide was swelled considerably, and that the filtration was extremely rapid.

I have repeated these experiments with gallic and with dilute hydrochloric acid.

In the first experiment the hide was freed from lime by soaking all night in water containing ¼ per cent fuming hydrochloric acid, and afterwards the water was removed by alcohol and the piece of hide was dried. A solution containing 0·1818 grm. dry gallic acid per 20 c.c., left on evaporation at 100° C, 0·1814 grm., and after filtration, only 0·1060 grm.—having lost 41 per cent.

In the second case the solution contained 0·094 grm. per 20 c.c., and left 0·069 grm., or a loss of 26 per cent. But in this case, say, 25 c.c. were rejected before taking the portion for evaporation. And we may assume that this had nearly saturated the hide. After this, dilute hydrochloric acid was passed through the same portion of hide. Before filtering, 20 c.c. = 6·1 c.c. normal soda, after filtering 20 c.c. = 4·8 c.c. soda, showing a loss of 1·3 c.c., or 21 per cent. By this process the hide was much swollen and rendered practically impervious to water, so that I completely failed in forcing a further portion of gallic acid through it.

A further portion of hide, of medium thickness, which had been preserved in a dilute solution of borax, was well washed first in water, then in dilute hydrochloric acid, and then again in water, and then a centinormal solution of HCl was forced through it. After, perhaps, even 100 c.c. had passed through, no trace of acid could be detected in the filtrate. A 5 per cent normal solution was then substituted, and the hide rapidly swelled and became impervious to water; but throughout no trace of acid passed through. I may here remark that my experience is quite contrary to the assertion of Müntz and Ramspacher, that swelling facilitates the passage of the fluids.

I must admit that my experiments are as yet too incomplete to allow me to speak with absolute certainty; but the conclusion which I draw from them is that the gelatinous tissue of raw hide enters into a sort of loose chemical or semi-chemical combination with acids, by which it has the power of withdrawing them from their solutions. It is probable that this combination is something of the nature of a solution of the acid in the gelatinous substance, which is very much swelled thereby. On steeping for some time in water, a certain amount of decomposition sets in, and the hide "falls," the acid probably being neutralised by the ammonia evolved. The same effect takes place rapidly in dilute ammoniacal solutions.

Since about 2 per cent solution of tannin is the strongest which is suitable for use in this process, it is obvious that the above cause must seriously interfere with its accuracy, even if it does not render it entirely fallacious. Another source of inaccuracy is that it is very difficult to ensure complete absorption of the tannin. Even with a 1 per cent solution only, a considerable quantity passed through a piece of hide 2 to 3 m.m. thick, as was shown by its forming a precipitate with gelatin and with ammonio-acetate of copper.

* Read before the Newcastle-on-Tyne Chemical Society, March 23, 1876.

Action of Animal Charcoal on Ammoniacal Salts.—M. C. Birnbaum and A. Bomasch (*Dingl. Poly. Journ.*). Animal charcoal withdraws very little ammonia from a dilute aqueous solution of caustic ammonia. Ammoniacal salts also are only absorbed in small quantities, a small portion of the salt being decomposed. This decomposition is more considerable for the ammoniacal salts of bibasic acids than for those of the monobasic acids.—*Bull. de la Soc. Chim. de Paris.*

PROCEEDINGS OF SOCIETIES.

PHYSICAL SOCIETY.

June 10th, 1876.

Professor G. C. Foster, F.R.S., President, in the Chair.

Mr. W. J. Wilson exhibited and explained a Reflecting Tangent Galvanometer, which he has recently designed, for the purpose of exhibiting the indications of the instrument to an audience, and so arranged that the divisions on the scale show, without calculation, the relative strengths of different currents. It should be observed at the outset that this object cannot be attained by attaching a mirror to the needle, as in the ordinary galvanometer, as the angle passed over by the reflected ray is double that through which the needle is deflected. In the arrangement exhibited, the beam of light, after passing through a small orifice traversed by cross wires, is reflected vertically by a fixed mirror; the ray then passes through a lens, and is again reflected from a small plane mirror parallel to the first, which is rigidly fixed below a small magnetic needle. By this means the ray becomes again horizontal, and, since the light now falls on the second mirror always at the same angle, the extent of motion of the ray is identical with that of the needle, and, if the scale be one of equal parts placed in the magnetic meridian, the indications on it will be proportional to the tangents of the angles, and, therefore, to the strengths of the currents. The needle and mirror are suspended by a silk fibre, and a bent strip of aluminuim, the ends of which dip into water in an annular trough, is attached to the needle in order to check its oscillations. A series of observations, taken with varying resistances introduced into the current, showed that the indications are very reliable.

Mr. S. P. Thompson then exhibited an Electromotor Clock, made by Mr. W. Hepworth, of York, and provided with a commutator of Mr. Thompson's design. This part of the instrument is very simple, and reverses the current at each single oscillation by means of two light springs resting on inclined planes. The motion of the pendulum drives the train of wheels by a modification of the gravity escapement, and a very small battery power is sufficient.

Prof. G. Fuller, C.E., exhibited and described his "Electric Multiplier," an instrument which may be looked upon as an automatic Electrophorus. An insulated plate of vulcanite is supported in a vertical position, and on each side of it is an insulated metallic plate, and these can be moved together to and from the vulcanite by rotating a handle. When these plates are far apart, two metallic arms, provided with points, are made to pass one on each side of the vulcanite plate. One of these is insulated, and is provided with a rod terminating in a nob, which at a certain point in its path almost touches the metallic plate on the opposite side of the sheet of vulcanite. The other arm is in connection with the earth. The action of the instrument is as follows: a charge of, say, negative electricity having been given to the insulated arm, it is passed over the face of the vulcanite, while positive is drawn up from the earth and thrown upon the opposite face by the uninsulated series of points. These arms are then removed, and the two metallic plates are brought into contact with the vulcanite. Call the side of the plate charged with negative electricity A, and the other B. The negative of A induces positive on the near face of its metallic plate, and repels the negative. This passes, by a strip of tinfoil joining the two faces of the vulcanite, to the other metallic plate, neutralising its free positive; and when the plates are moved away from the vulcanite, that from A is charged with positive, and that from B with negative. Before reaching its extreme position, this latter communicates its charge to the insulated arm by the brass knob, and the electricity is then distributed over the face A. At the end of its path, B is momentarily connected to earth. It will be evident that the effect of again bringing the plates in contact is to increase the charge of positive electricity on the metallic plate opposite the face A. With the small model exhibited, Prof. Fuller has frequently obtained sparks an inch in length.

Prof. Guthrie then exhibited and employed Prof. Mach's apparatus for sound reflexion, which is one of an interesting series of appliances designed by him for the demonstration of certain fundamental principles in physics. It consists of a mathematically exact elliptical tray, which is highly polished, and provided with a close-fitting glass cover. The tray is covered with pulverised dry silicic acid, and a Leyden jar frequently discharged between two small knobs at one of the foci, when the silicic acid arranges itself in fine curves around the other focus.

CORRESPONDENCE.

THE CHEMICAL SOCIETY.

To the Editor of the Chemical News.

Sir,—The subjects which are agitating the minds of the members of the Chemical Society—namely, a somewhat indiscriminate process of blackballing, and a desire to give the profession of a chemist its due importance before the world—appear to be closely connected, and to need some disentanglement from the confusion into which they have fallen.

So long as the sole designation by which a professional chemist can be distinguished is that of the three letters F.C.S., an endeavour to make the Chemical Society an Institute like that of the Civil Engineers, or of the Architects, and unlike the sister Societies of Geology and Astronomy, or the Linnæan and the Geographical, is not unreasonable. On the other hand, so soon as some designation shall have been found which serves the desired purpose of assigning his due *status* to a qualified chemical practitioner, the position of the Chemical Society becomes in no sense different from that of either of these Societies.

The position assigned to our national scientific Societies by their charters, and established by their rules, is quite definite. A legal *status* has been awarded to them, and to certain of them the country gives a local habitation as well as a name, on the understanding that they are to promote their several sciences on a voluntary principle, and in a manner that shall not be tainted by a commercial spirit.

A man may be a member of the Astronomical or of the Geological Society who has never looked through a telescope or wielded a hammer. He need neither be able to read the stars, calculate a trajectory, or know the characters of a shell, a mineral, or a rock. And, notwithstanding that these Societies largely recruit their numbers from men who are purely amateurs—men who like to enlist among the more vigorous students of a science, to get copies of the Transactions as they are published, to attend the meetings for the instruction they afford and the advantage of talking to those who are more conversant with their subject—yet no one will say that these Societies have failed in honourably and most worthily holding aloft the standard of their sciences. And they have done so, notwithstanding that instrument makers, shell, fossil, and mineral dealers have been able to put F.R.A.S., F.L.S., F.G.S. after their names, and even flaunt them in advertisements.

Why should not the Chemical Society be equally large-minded and comprehensive in its admission of men who are not professionally chemists to its ranks? The answer is, of course, on everybody's lips. It is, in a word, that

Chemistry is a profession as well as a science, and some members of the Chemical Society think that the Society should be the guardian of the professional as well as of the scientific functions of chemistry. The Society will certainly have fallen on evil days when these two functions shall have been permanently confounded; the honourable and important profession of the chemist will not have emerged from its anomalous and unrecognised position until, with or without the help of the Society, it has separated these functions completely, and organised the means of distinguishing the skilled practical chemist from the amateur or the purely philosophical student of the science.

This organisation is now being arranged by its natural leaders, and surely it is no longer necessary or desirable to arrest the growth of the Chemical Society by a process of very indiscriminate blackballing. The Society discharges three important functions: it offers at once a library and a rallying point for all whose daily work or whose intellectual sympathies guide their steps to the shrine of chemistry; it publishes the memoirs in which a small proportion of its members contribute the greater part of what England adds to the archives of chemical science; and it now gives its members the best existing digest of the chemical work of the whole world.

To carry out these three objects thoroughly it must be a large Society, by no means limited to the actual working and practising chemists, and it must have the disposal of considerable funds.

And surely we are passing out of the days of exclusiveness. Why, for instance, should a man be blackballed and excluded from our Society because his calling and designation is that of a science teacher? Such a man, if he is to teach chemistry worthily, would be better, and the chemists of our Society would be none the worse, for his having the opportunities the rooms at Burlington House afford for his occasionally recruiting the knowledge he is to impart from the fountain-head. Surely it would be a miserable jealousy to push out such a man as not being "one of us," because he may not have fulfilled all the conditions properly demanded by an Institute of professional chemists from its members. It is really for the advantage of such men that the country supposes our national scientific societies in great part to exist. I will not dilate on the obvious fact that the recent blackballing has not been carried on entirely upon a high if mistaken principle. It has been singularly indiscriminate, and even the most honoured names subscribed as vouchers for the acquirements or fitness of a candidate have been contemptuously disregarded by the small minority into whose hands the secresy of the ballot-box puts so much power.

Now, I argue from this, that there is probably a certain amount of personal feeling mixed up with the higher sentiment, and, since such feelings are transient, this part of the motive will ere long cease to exist; while, on the other hand, the impending organisation of the chemical profession will take away the only permanent source of the motive that is applying this drastic and indiscriminate purge to the Society. The object of my letter, then, is to suggest to the discontented few, first, that next to the interests of the science they would probably place those of the Society in their good wishes; that no great principle is any longer at stake in the election of candidates who, without being professionally chemists, bring on their papers the names of men generally respected in the Society; that, where the shafts fly so indiscriminately in the dark, good men will be scared, and will not let their names be the target for such random shooting; and, finally, that if there is any just ground for complaint as to the use made of the F.C.S. by a few people whose names are on the list, let the complaint be laid before the council, and action be taken on it by that body and by the Society at large. If this somewhat unseemly contention goes on, it will soon begin to be felt in the falling off of the Society, not only in numbers, but in the estimation of the world; for the exclusion of good men, whether by the poinard of the ballot-box, or by the fear of its stroke, will soon produce its effects, and one of these effects will be a large diminution in the authority and in the efficiency of what till now has been one of the most efficient and well-sustained of our national Societies.—I am, &c.,

Nevil Story Maskelyne.

To the Editor of the Chemical News.

Sir,—I am at a loss to understand the tactics of those Fellows of the Chemical Society who, by anonymous letters in your columns, uphold their action in blackballing candidates upon the grounds that these candidates have not given evidence of having done original work. Surely, Sir, this is a strange means of improving the Society. Would it not be a better plan if these anonymous gentlemen were to favour the Society with some more original work of their own?

I, Sir, not long ago proposed for election a worthy friend of mine, who is a hard-working, clear-headed, science teacher in the North of England. He is, in my humble judgment, just the kind of man whom the Society should delight to honour,—one who, withstanding the ordinary allurement of a business career, devotes his life to science teaching. Little pay, little social consideration, does the science teacher in England get; but recognition by a brotherhood of scientific men—or, at any rate, of persons forming a Society for the encouragement of Science—he surely might expect. But no! the anonymous gentlemen and their friends are so intent on *original* research that they see no merit in any other form of scientific work, and my friend was blackballed for the purpose of "improving the Society."

Sir, this state of things cannot go on. I do not know what action the President and Council intend to take in the matter. I write as an outsider. Of this, however, I feel confident,—that unless this meaningless, ill-natured (I can use no other word) blackballing of candidates simply because they have not done original work, by persons who do not show us that they have ever done anything themselves, is put a stop to, the Chemical Society will soon come to an end.—I am, &c.,

H. E. Roscoe.

Athenæum Club, Pall Mall, S.W.,
June 13, 1876.

To the Editor of the Chemical News.

Sir,—It is only necessary to glance at your columns weekly to observe the wide and increasing sympathy of a large body of the Chemical Society with the so-called blackballing movement alleged to have been originated by certain younger members of the Society.

Ill-inspired by the conciliatory speech of the President some few meetings since, relative to this matter, which was received with such due courtesy by the Fellows present, some by no means elder members have presumed, in questioning their discretion, to rebuke these mysterious offenders; indeed, to use a colloquial but extremely apt expression of low comedy, have been playing the "heavy father" to them.

Paternal advice, however, requires support of a very substantial character, and necessarily falls somewhat flat and unheeded when given vicariously. Moreover, the "young men" alluded to are earnest and competent men, enthusiastic in the interests of their science, and strong of purpose. Having managed to get themselves admitted into the Society, they have nevertheless managed to raise its *status* by communicating original research; and seeing that the honour of the Society—and of a consequence their own honour—is threatened, in that that same learned Society is in danger of becoming a mere Club, the excuse for whose membership shall be a sham of chemical knowledge, they have made a stand against an infringement of their privileges, just as a certain young parliament—afterwards known as the Long Parliament—fought for its rights in days gone by; they have roused a storm of

opinion which no jocose banter can lull, and which, when spent, will be found to have considerably cleared the chemical atmosphere.

This, Sir, is one view of the subject; but there is a more neutral, less controvertible, point of view upon which I should like briefly to touch.

There can be no doubt that the Chemical Society counts among its Fellows all the leading chemists of England. Some of these, in addition to the communication of original research, take a justly appreciated interest in the actual welfare of the Society itself.

Now, Sir, such a Society should be a true republic of Science, where individual expression of opinion is met with attention and welcome by all, but more especially by those necessarily placed in the position of power by the great body of members.

It is evidently felt that in the Chemical Society this at present is not so,—that the opinions of many Fellows obtain no adequate representation, and can therefore only find immediate expression through the medium of the Press. Where perfect understanding does not exist, secret opposition has arisen. The case in point is the protest which has made itself heard through the ballot, by so large a section of the Society, against the admission into its ranks of men who have no place there. The arguments advanced in defence of this protest are strong; the increasing evil detracts from the *prestige* of the Society—it misleads the public; it produces, worse than all, discontent in the Society itself. But the strongest of all arguments that can be adduced is the fact that meetings have been, and are being, held with a view to bringing about so-called "organisation among chemists;" in other words, various plans have been put forward by means of which competent Fellows of the Chemical Society shall be distinguished from incompetent Fellows. Some propose the Utopian notion of a self-regeneration of the Society; we are to have Licentiated Fellows and Ordinary Fellows—perhaps the initials C.F. (Competent Fellow) and I.F. (Incompetent Fellow) are as good as any yet suggested.

It seems to me, Sir, therefore, that what is before all to be wished, with regard to the Chemical Society, is that openness of discussion should replace the present deplorably anonymous and restricted expression of opinion—that, especially with regard to the admission of Fellows, this would be conducive to a healthier state of things.

In conclusion, allow me to remark, Sir, that Fellows in voting by ballot act according to their own logical convictions, and that, this being so, the late severe black-balling must be looked upon as an expression of opinion on the part of certain Fellows whose names the ballot forbids us even to surmise. At the same time I would, with all deference, remind certain of your correspondents that it is as great an abuse of the privilege of ballot to accuse Fellows of indiscriminate blackballing as it would be to blackball from any other motive than conscientious conviction.—I am, &c.,

C.F.C.S.

To the Editor of the Chemical News.

Sir,—John Dalton, teacher of mathematics, must we not elect him a fellow of the Chemical Society? Wm. Herschel, organist; R. I. Murchison, retired officer, fox hunter; Lord Rowe, Irish Peer; Connop Thirlwall, Clerk in Holy Orders, afterwards Bishop; G. Grote, banker—are they not fit company for men of science? In our zeal to exclude mere dabblers in science from the Chemical Society do not let us exclude the *dilettanti* in the true sense of the word, the men who delight in science whether they live by it or no.

I cannot but fear that the views of some of your correspondents as to qualifications would, if adopted by the Society, practically exclude all those who do not make a profit out of chemistry, and make it easy for those to enter whose love is not for science but for what they can get out of her, and who would be far more likely to injure the standing of the Society than any dabblers. On the other hand, the proposed plan of limiting election to those who have contributed papers of value would make the Society very select; but has the proposer counted how many of the present Fellows could claim election under such a rule; or if it were applied to the Royal Society how many even of that select body would find themselves shut out?

It is often impossible to particularise in two or three words the reasons that the proposers have, or should have, for knowing that a candidate is a really scientific man, and unless it is found safe to trust largely to the discretion of others who have signed papers, the only way to do real justice to the Society and to the candidates would be to alter the rules of election in such a manner as to ensure a fair investigation into the real merits of a candidate before presenting him for election to the whole body.

As far as I can recollect I am not acquainted with any of those gentlemen whose failure to secure election has caused so much comment, but I am strangely misinformed, if, in some cases, they would have been rightly excluded by the most rigid rules proposed by any; and, on the other hand, we must not forget that it was to the public spirit shown in openly warning us that we owed the certain rejection of one whose fate I have heard no one lament.

I hope that at least the attention called to this subject will have the effect of inciting all those who attend the meetings to take a real interest in the elections, so that the result, be it admission or rejection, may be the expression of the opinions of a sufficient number to give it real weight, as representing the general opinion of the Society. —I am, &c.,

David Howard.

Stamford Hill, June 12, 1876.

To the Editor of the Chemical News.

Sir,—As some Fellows of the Chemical Society are suffering from obtuse vision of the state of that Society's affairs, perhaps I may be allowed to explain what the present discontent means.

Some time since the Chemical Society saddled itself with an expensive though valuable journal, the publication of which costs more money than can well be found. To meet this expense the portals of Burlington House were thrown open to all comers, and for a time there was witnessed a disgrace which, it is to be hoped, will never again be experienced. Tradesmen from pure conceit sought the Fellowship, and men who held bogus degrees rejoiced at the opportunity thus afforded them of swelling their bubble greatness. But there were men who watched and who felt the sting of this disgrace, and a stand was instituted to oppose this growing vice. It is now eighteen months since some few gentlemen, including the writer, became a nucleus for the movement, which has gradually absorbed into its vortex numerous followers and able leaders.

Mr. C. E. Groves is totally at sea when he attributes the movement to a "few young men," for, although instituted by young men, it now embraces men of all shades of thought and position and certainly includes best part of the *working* men of the Society.

Mr. Groves will pardon the writer for regarding *him* as a young man, and for calling his attention to the fact that progress in every direction is always more or less the work of young men.

In war it is an object of care not to let the enemy have knowledge of your strength, but we can afford to neglect this precaution, for there can be no doubt that the movement under discussion is well supported, and in spite of all opposition it will accomplish its object.

Young chemists (and they are the men who carry on the work of these days) know too well how disposed

certain older Fellows of the Society are to stand still; they have secured their reputation; their position socially and professionally is determined. But it is to be feared that these same men often fail in that generosity of character which should prompt them to help younger men, as they themselves were helped in days when chemistry was not what it is. There is in England no University, no Corporation, no Organisation which stamps the chemist but the Chemical Society. Shall we, then, admit into our body men having no qualifications, and, in some instances, no principles? Are these men to become our compeers, our professional brethren?

If the Fellows of the Chemical Society will but look around they will at once perceive that those who hold aloof from the present movement are those older Fellows of whom we have spoken and some few younger men who follow in the paths illuminated by the light which they reflect as satellites to the greater planets. Astronomers know, however, that the common stars are, in many instances, of greater size than the planets which appear larger by reason of their greater proximity to the observer.

The meaning of the present outcry for organisation of chemists is but too evident. Its history is that of the movement under discussion, and it points to one and the same truth. The Chemical Society has suffered disgrace by the admission to its Fellowship of men who ought to have been elected only as Associates, or have been rejected altogether.

The men who are so indignant at the recent blackballings at the Society would have a difficulty in explaining why on the lists of the Society there appears the name of only *one* Associate: and greater difficulty still in explaining how men as Associates would fail to advance chemical science equally as when Fellows, if the only way in which they can do this is by subscriptions. As a matter of fact the scheme for the Organisation of Chemists, suggested by Prof. Frankland, amounts to a revival of the distinction of Fellows and Associates. That is to say, he proposes that whereas all existing members shall be still considered as Fellows, a higher distinction shall be given to those among them who can produce the necessary qualifications!

We sincerely trust that this scheme may be adopted, but until the future is provided for the present movement in the Chemical Society will be continued.

In conclusion, I would suggest to the younger Fellows of the Society henceforth to place their confidence in men elected from their own body, who will sustain the reputation of chemists and the Chemical Society. In like manner they should be well and largely represented in any scheme of organisation that may be developed, or, failing this, they should energetically resist it.—I am, &c.,

F.C.S.

To the Editor of the Chemical News.

Sir,—Your correspondent "Twig," and other gentlemen who have written to the Chemical News, are no doubt actuated by a desire to do what is right, and forward the interests of the Society of which they are members, but the opinions which they apparently entertain do not accord with my own. I do not approve of all candidates for election being "blackballed" because they have not pursued a strict course of study. But I do hold that a man must have some knowledge of and show interest in the subject before he can in any way contribute to "the advancement of Chemical Science." I cannot regard his scription of two guineas per annum as a substitute for his want of such knowledge. A display of ignorance coupled with the letters F.C.S. is calculated to do more harm than the lack of many subscriptions. Your correspondent says—Is the Chemical Society to be an association of chemists or an assemblage of indescribables?" And, again,—"As long as the Chemical Society is supposed to represent chemists," &c. I may ask, What is a chemist? I have my own independent opinions on this as on most other subjects, but I confess I am ignorant of any received definition of such a being. Another correspondent says—"It is useless to deny that the world looks upon these titles which Societies grant as a species of degree, and that their possession is a guarantee of the holder's proficiency in some branch of science," and I may add that a recent article in the *World* made this very evident.

Collating the ideas and expressions of opinion, and reducing them to their simplest form, we arrive at the following conclusions:—

(1.) That the public regard the Fellowship of the Chemical Society as a sort of degree, or stamp of considerable knowledge and skill in the Science of Chemistry.

(2.) That the Society consists, mainly at least, of two classes of Fellows, *dilettanti* and workers.

(3.) That there being no distinction between the two inconveniences arise therefrom.

(4.) That the course of study for a chemist should be strictly defined.

A large amount of private correspondence with gentlemen in the country, which I have in my possession, calls for some organisation, and the facts here deduced show that this is not only desirable but necessary, because the Chemical Society appears to occupy a false position. My previous remarks on the care necessary in signing certificates arose from facts which have come within my ten years' experience. A certificate arrives by post, with a request to sign either from personal or general knowledge, the candidate being a stranger to the receiver of the letter, and unknown by any published papers. Occasionally a similar request is made in the lecture room, where one's only acquaintance with the candidate is the general contour of the back of his head. Other cases I will not enter into.—I am, &c.,

W. N. Hartley.

King's College, London,
June 13, 1876.

To the Editor of the Chemical News.

Sir,—The discussion now going on in your columns on the subject of the qualifications for admission to the Chemical Society cannot fail to be of the greatest moment to all interested in chemistry, both as a science and as a profession in which to gain a livelihood. It is not only to Fellows of the Society that this question is of interest. There are many, very many, who, like your correspondent "P. H.," have never yet offered themselves as candidates for election, simply because they knew how utterly worthless is the "distinction" F.C.S., and because they have seen it granted to so many whose claims to any knowledge of chemistry were perfectly absurd; also because they see how shamelessly the F.C.S. may be used as an advertisement without calling forth any notice from those at the head of the Society. Yet all those who keep aloof on these grounds would gladly have entered the Society if it had been what it should be, and what many people who do not know it still imagine it to be; and they will be very glad if Messrs. "Twig" and "Nuntius," and the other blackballers succeed in forcing the governing body of the Chemical Society to alter the rules in some way so as gradually to rescue it from the absurd and undignified position in which it now is, when so many of its own Fellows have to speak of it with contempt.

The letter from Mr. Pettengill is also of interest, inasmuch as it probably sets forth the views of a body of chemists as to the constitution and working of the much talked-of proposed Institute of Chemists. If such a body comes into real and active existence, nobody is likely to object to its rules being so framed as to completely exclude all who have not had a proper course of original training in a recognised manner and of sufficient duration, followed by a good period of practical occupation in the profession. We do not know as yet who are Mr. Pettengill's "clients," but it seems as if they were going to place themselves in a

very ambiguous and somewhat ridiculous position in one respect. Why on earth should Fellowship of the Chemical Society have anything to do with admission to membership of the proposed Institute? Surely this latter ought to be perfectly independent in every respect; and it is, at any rate, a very ill-chosen moment to propose any such rule as requiring candidates for the Institute to first be F.C.S., when the Fellows are disputing among themselves whether or not any *chemical* qualification is to be demanded before election to their Society, and when their President has distinctly stated that none such should be required. Now, if any kind of amateurs, and people with a "general interest" in chemistry are to be held eligible for the F.C.S., what possible qualification can the F.C.S. confer upon anybody as regards membership of a guild of purely professional chemists? It seems to me, and to others to whom I have spoken, that this proposed rule, and also that of giving the nomination of several members of the Council of the proposed Institute to the Council of the Chemical Society, can lead to but one inference. It looks as if the "clients" of Mr. Pettengill were afraid of treading on the toes of the Chemical Society, and had cooked up this very singular proposed rule as a kind of "sop" to that body—to compliment them, and perhaps indirectly add to the number of Fellows and consequent revenue.

Let the proposed Institute come into being as soon as possible; but let it have enough backbone to stand by itself for its own specific aims and ends, and not stultify itself by any such queer arrangement as that alluded to. If such a rule were really confirmed, one qualification for membership would be held by many "chemists" who never did a bit of chemical work in their lives. It is, indeed, high time that something was done to raise the position of chemists. All well-wishers of the Chemical Society must be glad to see an agitation which will, perhaps, put an end to this bad state of things. All well-wishers of the proposed Institute will desire that it may in no way connect itself with the Chemical Society, unless the latter is very much reformed in some respects.—I am, &c.,

ANALYST.

London, June 13.

UNITY AMONGST CHEMISTS.

To the Editor of the Chemical News.

SIR,—The discussion which is going on in yonr pages must have convinced the most sceptical that we are rapidly approaching a period when it will be wise and expedient to found a corporation which shall be the representative alike of the chemists and chemistry of England. We may therefore expect that questions, deeply concerning all engaged in chemistry, will soon be raised, when, let us hope, they will be freely discussed.

At present chemistry is in some sort of way represented by the Chemical Society; analytical chemisty by the Society of Analysts; and technical chemistry by the Chemical Section of the Society of Arts. But it is apparent that not one of these commands the full respect of chemists, and this for the obvious reason that they are not associations of chemists. Had it been otherwise, one or other of them might have been taken without hesitation as the nucleus of the desired institution.

It is now proposed to found what will be the fourth chemical organisation, whose primary function shall be "the general advancement of technical chemistry in its application to the arts, manufacturers, agriculture, and public health." The object of the promoters of this undertaking is laudable, and doubtless would command the general support of chemists—at least as to its principle—were it not for existing bodies which profess to do much the same thing. If organisation is to mean disintegration, it appears to me that we have had enough and to spare, and what we really want now is unity. It is the first essential to a country's greatness, and is absolutely necessary for chemistry to attain to its maximum as a source of power.

Naturally we seek for the uniter of chemists—in fact the Bismarck of chemistry—in the Chemical Society. Grant that this, the oldest of chemical organisations, has striven to do its work through one small channel only, and has neglected altogether the interests of chemists, yet it contains within its ranks all the chemists of whom Great Britain has reason to be proud.

It would be more gratifying to me were I to hear—instead af a proposal to found an institute of professional chemists, or one for technical or scientific chemists—a proposal to found simply an institute of chemistry, whose doors should be open to all (after, of course, giving proof of knowledge and skill) engaged in chemistry whether technological or scientific. Chemistry, being so vast, makes it absolutely impossible for one mind to grapple or do justice to it as a whole, which leads me to think that, in the event of an institute or society of chemistry being founded, or the Chemical Society reformed, it would be well were it divided into sections. Let the president of the institute or society, say, be the chairman of the scientific section, and other distinguished men appointed to the chairmanship of the technological, analytical, or other sections.

The entrance to such a body should be made sufficiently difficult to ensure respect, and should be obtainable through (1) original work in any branch of chemistry, or (2) examination in the practice and principles of chemistry.—I am, &c.,

ALFRED TRIBE.

Dulwich College, June 13, 1876.

ORGANISATION AMONG CHEMISTS.

To the Editor of the Chemical News.

SIR,—The appearance of Mr. Pettengill's letter in the CHEMICAL NEWS (vol. xxxiii., p. 240) makes it desirable that gentlemen interested in the question of "Organisation amongst Chemists," should be informed that energetic steps towards the attainment of this object have been taken, and that the following brief report of what has been done should be laid before them.

After a large amount of private correspondence with most of the leading chemists in the United Kingdom for the purpose of eliciting views and opinions, the Council of the Chemical Society was asked for and kindly granted the loan of their meeting-room for the purpose of holding a *private* meeting to consider the question generally. The President of the Chemical Society kindly consented to take the chair at this meeting, which was duly held on April 27, 1876, about one hundred and thirty of the best-known chemists having been asked by circular to be present, and about fifty being actually present.

Resolutions were finally passed as follows:—

I. That it is desirable that an Organisation of Professional Chemists be effected.

Carried unanimously.

II. That in order to effect this organisation it is desirable that a body be formed for the purpose of selecting as members of the organisation such persons as may be found to be competent chemists.

Carried unanimously.

Propositions were brought forward for the establishment of an "Instititute of Professional Chemists" as the "body" referred to, this institute being unconnected with any other existing corporation or society; and also for the alteration of the constitution of the Chemical Society so as to adapt it to fulfil the duties of the new "body." After a good deal of discussion a committee was appointed for the purpose of conferring with the Council of the Chemical Society, with a view of ascertaining how far that Society is able and willing to carry out a scheme for the

organisation of professional chemists, and the meeting was adjourned until such time as this committee should be able to report the results of their conference.

This committee consisted of the following gentlemen:—Mr. M. Carteighe, Mr. Dugald Campbell, Dr. E. Frankland, Mr. F. A. Manning, Dr. Redwood, Dr. Stevenson, Mr. Tuson, Dr. Voelcker, Mr. J. A. Wanklyn, Dr. C. R. Alder Wright, with Mr. W. N. Hartley as secretary.

This committee has met several times, and has conferred with the Council of the Chemical Society, which is now carefully considering the matter; as yet, however, this committee has been unable to report, because very great consideration on the part of the Council of the Chemical Society is requisite before a definite answer can be given. But it is believed that the Council of the Chemical Society will very shortly be able to give at least a provisional answer to the application made to them, and that this answer will take the form of a definite proposition for selecting from the general body of Fellows of the Chemical Society such as are found to possess skill and attainments sufficient to render them worthy of such a distinction, and conferring upon these some additional title, such as "Practising Fellow," or the like.

Probably before this proposition can be definitely made to the Organisation Committee, a general meeting of the Fellows of the Chemical Society must be convened, for the purpose of considering the desirability of such a course. Manifestly it may be that a majority of those present at such a meeting may think this proposition either objectionable on its own score, or less likely to effect the desired result than would be an institution starting *de novo*, and not fettered by a charter granted for purposes not altogether the same as those in view, nor by its government being necessarily either identical with or subordinate to the Council of the Chemical Society. In such a case, the letter of Mr. Pettengill clearly shows that the desired results can readily be obtained even without the concurrence and co-operation of the Chemical Society as a body. If, however, at such a general meeting of the Chemical Society the Fellows should give their assent to such alterations in the bye-laws of the Society, and in the constitution and mode of election of its Council, as may be necessary to render fairly practicable the scheme of uniting under one charter a purely scientific Society with a professional Association, there can be little doubt that this plan will commend itself to the acceptance of those present at the adjourned meeting of the promoters of the organisation movement.—I am, &c.,

C. R. Alder Wright, D.Sc.

Chemical Laboratory, St. Mary's Hospital, W.
June 11, 1876.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances, de l'Academie des Sciences. No. 21, May 21, 1876.

Fixation of Atmospheric Nitrogen by Vegetable Soil.—M. Th. Schlœsing.—All the experiments prove evolution rather than absorption. Neither sealed tubes, nor the passage of nitrogen through liquids, nor variation in the proportion of the reagents, nor the exposure of the earth in an atmosphere deprived of oxygen, have presented the phenomenon of the fixation of nitrogen.

Action of the Organic Acids upon the Tungstates of Soda and Potassa.—M. J. Lefort.—Of all the mineral salts regarded as neutral in accordance with their composition, there is none which shows so decidedly alkaline a reaction with litmus as the neutral tungstate of soda. In the diluted solutions of the neutral tungstates of potassa and soda the addition of certain organic acids such as the acetic, oxalic, tartaric, and citric, give rise to no apparent reaction. Under these circumstances there is a formation of acid tungstates, but in one special case these organic acids may behave like mineral acids, producing yellow tungstic acid.

Second Paper on the Theoretic and Experimental Determination of the Relation of Two Specific Heats in Perfect Gases whose Molecules are Monatomic.—M. Y. von Villarceau.—This paper consists chiefly of mathematical formulæ.

Lead Present in certain Platinum Points employed in Lightning Conductors.—M. S. de Luca.—It appears that the supposed platinum points of the lightning-rods attached to the Observatory on Mount Vesuvius has been adulterated with lead to the extent of 10 to 12 per cent.

Modification in Electric Batteries, rendering their Construction more easy and more economical.—M. Onimus.—The author substitutes parchment-paper for porous earthenware.

New Experiments on the Flexibility of Ice.—M. J. J. Bianconi.—The author finds that ice possesses a compressibility or plasticity, decided, but sluggish and very limited.

Nitrides and Carbides of Niobium and Tantalum.—M. A. Joly.—After referring to the researches of Wœhler and Ste.-Claire Deville, the author states that he has found that carbon combines with niobium, and that mixtures may thus be obtained containing variable proportions of nitride and carbide, the latter increasing with the temperature. Titanium also, like niobium and tantalum, combines with carbon and nitrogen, forming mixtures in various proportions.

Normal Pyrotartaric Acid.—M. Reboul.—This acid crystallises in triangular laminæ belonging to the clinorhombic and hemihedral type. Its analysis gives C = 45·2, H = 6·0, theory requiring C = 45·4, H = 6·0. It distils without alteration at 299°. Its point of solidification and fusion is 96°. It is very soluble in cold water, and in boiling water it dissolves in all proportions. It is also soluble in absolute ether and alcohol. The author has examined its neutral barytic, $C_5H_6O_4Ba+5H_2O$, and calcic salt, $C_5H_6O_4Ca+4H_2O$.

Electrolysis of the Derivatives of Aniline, Phenol, Naphthylamin, and Anthraquinon.—M. F. Goppelsrœder.—Reserved for insertion in full.

Nature of the Mineral Substances Assimilated by Fungi.—M. L. Cailletet.—There are differences between the composition of the ash of these plants and of such as contain chlorophyll. Chlorophyllous plants draw from the atmosphere under the influence of light carbon, oxygen, and hydrogen, whilst the lower plants—and in particular the fungi—seek the same nutritive elements in unstable compounds corresponding to what we call explosive bodies. This essentially different mode of nutrition may explain the notable differences found in the respective analysis of fungi and of chlorophyllaceous plants. Iron, one of the most important inorganic elements of the latter group, does not appear to be present in the fungi, which are poor in lime and magnesia, but very rich in alkalies and phosphoric acid.

Bulletin de la Societe Chimique de Paris, No. 9, May 5, 1876.

Normal Pyrotartaric Acid.—M. Reboul.—Not adapted for abstraction.

Products of the Addition of Hypochlorous Acid to Non-saturated Compounds, and especially to Propylen.—M. Louis Henry.—Already noticed.

Source of Carbonic Acid, Characteristic of the Formines and Polyatomic Alcohols.—M. Lotin.

Correspondence from St. Petersburg, Jan. 15, 1876.—M. W. Louguinine.—M. Menschoutkine, on behalf of M.

Bunge, communicated the results of experiments on the electrolysis of aqueous solutions of oxalic acid.

M. Boutleroff, on behalf of M. Saytzeff, described certain researches on diallyl-oxalic acid and on allyl-dimethyl-carbinol.

On behalf of M. Kolly he also communicated certain hypothetical views on the composition of glucose.

He also announced that pseudo-butylen obtained from secondary butylic alcohol dissolves in sulphuric acid less easily than isobutylen.

M. Dobroslavine described the results of experiments made with saliva upon different kinds of starch, and also laid before the Society a note on the application of caoutchouc stoppers for closing tubes in which it is intended to heat aqueous liquids above their boiling-points.

M. Goldstein has studied the action of chloride of benzoyl on dinitro-diphenol.

M. Mendeleeff finds that the application of Dalton's law to the determination of the composition of different layers of the atmosphere is confirmed by the analysis of air collected by Boussingault on the summits of the Andes, and by Miller's analysis of air taken in a balloon ascent.

The same part of the *Journal of the Russian Chemical Society* contains a memoir on the synthetic pyrotartaric acid of Simpson, by M. A. Lebedeeff; a paper on the presence of aceton in the urine of diabetic patients, and one on the laws governing the combination of non-saturated organic molecules, by V. Markovnikoff; a memoir on the transformation of certain hydrocarbides of the ethylenic series into corresponding alcohols, by M. A. Boutleroff; a paper by the same chemist on the milky juice of *Cynanchum acutum*; and one by E. Wagner on the action of zinc ethyl upon acetic aldehyd.

Revue Universelle des Mines, de la Metallurgie, des Travaux Publics, des Sciences et des Arts Appliques a l'Industrie, March and April, 1876.

Commercial Assay of Sulphate of Soda.—L. L. de Koninck.—The author after referring to his former paper (*Revue Universelle*, xxv., March and April, 1874) criticises the methods given by Mr. Tate (CHEMICAL NEWS, vol. xxix., p. 144), Mr. R. J. Tinniswood (pp. 164 and 205), and Mr. W. Simmonds (pp. 185 and 216). The author makes the curious mistake of rendering "high analysts" as "*les essayeurs en renom!*" He concludes:—"I still hold the method which I formerly described to be the best. The only modification which I introduce consists in the simultaneous determination of the alumina, ferric oxide, and sulphate of lime. For this purpose after having precipitated the alumina and iron with ammonia I add oxalate of ammonia to throw down the lime. The precipitate is collected upon a filter and washed, calcined, treated with a few drops of dilute sulphuric acid, and heated again to redness in order to decompose the sulphates of iron and alumina."

Ammonia Process of Manufacturing Soda.—M. P. Hanrey.—A history of the earlier attempts at the manufacture of soda in the manner in question from the first experiments of Dyar and Hemming to the successful results of M. E. Solvay, whose soda-ash is said to contain 99·4385 per cent of pure carbonate of soda.

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THE CHEMICAL NEWS.

VOL. XXXIII. No. 865.

ON MERCURIC IODATE: ITS PREPARATION AND REACTIONS.*

By C. A. CAMERON, M.D., F.R.C.S.,
Prof. Chemistry R.C.S.I., Medical Officer of Health and Analyst for Dublin.

THE author finds that the statements made by Rammelsberg and Pleischl that mercuric iodate cannot be obtained by precipitation, is erroneous, except in reference to mercuric chloride. Iodic acid added to hot solution of oxycyanide of mercury, in the ratio indicated by the equation—

$$(HgCy_2+HgO)+2HIO_3=Hg_2IO_3+HgCy_2+H_2O$$

gives a white amorphous precipitate, almost insoluble in water, attacked with difficulty by nitric acid, but soluble readily in hydrochloric acid. Iodic acid and alkaline iodates give the same kind of precipitate with nitrate and acetate, but not with chloride of dyad mercury. However obtained, mercuric iodate dissolves very readily in solution of alkaline chlorides, bromides, iodides, cyanides, and cyanates, in disodic hyposulphite, and in hydrochloric acid. It is also soluble in dilute solutions of manganese and zinc chlorides. It is insoluble in solutions of potash, soda, ammonia, sodium sulphite, borax, corrosive sublimate, hydric disodic phosphate, alkaline iodates, chlorates, and bromates, and in acetic, fluoric, and silicofluoric acids. Treated with hydriodic acid or hydrobromic acid, mercurate iodate is dissolved with liberation of bromine and iodine. Mercuric bromate does not dissolve when treated with alkaline iodides, chlorides, &c., but they turn it brown.

When mercuric iodate is dissolved in chloride of potassium, chloride of ammonium, iodide of sodium, &c., and the solution evaporated, the salt which crystallises out first is an alkaline iodate, whilst the mercury converted into chloride forms, with excess of the solvent, a great variety of crystallisable double salts. In the cold 4 atoms of an alkaline iodide, &c., dissolve 1 atom of mercuric iodate; at a boiling temperature 2 atoms suffice.

From solution of Hg_2IO_3 in $Na_2S_2O_3$ hydrochloric acid throws down a red precipitate soluble in excess of acid, and Hg_2IO_3 dissolved in NH_4Cl gives with ammonia a white precipitate insoluble in ammonia. These precipitates have yet to be examined. A mixture of potassium chlorate, mercuric iodide, and water heated in a sealed tube up to 170° C. undergoes no change, but at 200 C., and especially with excess of chlorate, the scarlet colour of the iodide soon vanishes; on cooling, the tube is found filled with crystalline tufts, and its contents dissolve completely in water. On evaporating the solution, potassium iodate crystallises out, leaving $HgCl_2$ in solution.

ON THE PRODUCTION OF CARBON PROTOSULPHIDE.

By SERGIUS KERN, St. Petersburg.

THE discoverer of this compound, M. Sidot, described a year ago the results of his researches on the decomposition of carbon disulphide under the influence of solar light (*Comptes Rendus*, 1875, tome lxxxi., No. 1). The light was acting on sealed tubes containing carbon disulphide for about two months; the compound was then decomposed without the production of gaseous matter, sulphur was obtained in solution, and a reddish-brown matter was precipitated, which Sidot found by analysis to be a new compound, viz., carbon protosulphide (CS). The same compound has been obtained by me in the following manner:—In a test-tube ordinary carbon disulphide (crude) was poured, and some pieces of clean and pure iron-wire were placed in the tube, which was next well corked and left for about one month and a half in my laboratory. On then opening the tube, the liquor in it was found to be water, which had been present as an impurity. Reagents showed in the liquor not the least presence of carbon disulphide. The test-tube contained a reddish-brown precipitate; the pieces of iron-wire were partly covered with the same precipitate, and had diminished in weight. The precipitate was found to be a mixture of iron disulphide (marcasite) and carbon protosulphide, which was produced by the reaction:—

$$2CS_2+Fe=FeS_2+2CS.$$

As carbon protosulphide is nearly insoluble in hydrochloric acid, it is easily separated from the iron disulphide by means of this reagent; the CS is then liberated in the form of reddish-brown flocks.

The compound obtained, as described above, is an inodorous powder, insoluble in water, alcohol, and also nearly insoluble in carbon disulphide. Sulphuric and hydrochloric acids have no action on it.

I have now prepared some grms. of carbon protosulphide, and the reactions of it with some other compounds will be communicated.

* Abstract of a paper read before the Society of Public Analysts, 14th June, 1876. Communicated by the Author.

REPORT ON THE DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 244.)

Chlorine, Bromine, Iodine, and Fluorine.

By Dr. E. MYLIUS, of Ludwigshafen.

THE refrigeration of the gases, especially those from the calcination spaces, is most conveniently effected by means of cold air. Cold water is, indeed, employed as a refrigerant in some establishments in Germany and France, but the difficulties involved can only be successfully combatted on the small scale. In larger works cold air is preferable and is universally employed in England. Refrigeration becomes absolutely necessary where reverberatories are used for calcination, and the gases pass at once into the coke-towers. In this case the heat is so considerable that the coke may take fire, a result which has actually happened.

The apparatus employed in English works for cooling the gases consists chiefly of pipes which are either conducted straight onwards with a slight inclination, or where it is desirable to economise space, are arranged descending and ascending in the form of a U. These pipes are made of fire-clay of from 0·4 to 0·6 metre internal diameter, and fit into each other by means of contracted ends. The joints are made good with a mixture of fire-clay and coal-tar. If possible this series of pipes is carried with a fall of 0·05 to 1 metre for 35 to 70 metres to the condensers, which, to obtain the strongest possible acid, may be either Woolf's bottles or, as in many cases preferable, stone troughs. The latter have the great advantage that the many elbows of the connecting pipes, which impede the movement of the gases, may be more easily dispensed with. They are best made of sand-stone

* "Berichte uber die Entwickelung der Chemischen Industrie Wahrend des Letzten Jahrzehends."

slabs let into each other and held together with tie-rods which pass through the projecting ends of the side slabs. Or the slabs are fitted together with their edges bevelled to an angle of 45°, tightened by the interposition of strips of caoutchouc, and the whole clamped together with a somewhat expensive iron frame work. Lunge decidedly recommends the former plan. Troughs cut out of a solid block are sometimes used in Germany, especially in the neighbourhood of sand-stone quarries. Such, however, if of large size are very costly, and if once damaged can scarcely be repaired. The sand-stone used in Germany after it has been shaped out requires to be saturated with coal-tar, as it is otherwise unable to resist the action of the acid. Very hard stone, such as the carbonaceous sandstone (Kohlen sandstein) quarried at Herdecke and Wetter, in Westphalia (Hasenclever), does not require this preparation. Many English sandstones are sufficiently compact to resist the muriatic acid without any preparation (see the section on bromine below).

In these stone troughs a great part of the muriatic acid is condensed. The gases not condensed pass into the base of a coke-tower divided into two sections. They ascend in one of these and descend in a pipe fixed outside the tower, ascend again in the second compartment of the tower, and are thence led through a descending pipe into the chimney. The exit pipe is fitted with a damper to regulate the draught. The second compartment of the tower serves especially to free the gases which pass through it entirely from muriatic acid. According to the arrangement described the gas traverses both sections of the tower in a direction opposite to the descending current of water. It would be possible to dispense with the two external descending earthenware pipes if the two towers were connected above, and the gas were allowed to pass in the second tower in the same direction as the water. Thereby, however, a much less perfect condensation would ensue in the second tower, and a larger descending flow of water would be required.

(To be continued)

ADDITIONAL NOTE ON BALANCES.*

By Prof. ALDIS.

An examination made by Prof. Herschel of Bunge's balance since the last meeting gives the following dimensions, with the notation of the former note:—

$a = 64$ m.m. $h = 0$ (probably). $k = 0{\cdot}175$ m.m. $W = 40$ grms.

A similar examination of a balance by Kleiner, which has been used in the laboratory for some time, gives for that balance—

$a = 198$ m.m. $h = 0{\cdot}5$ m.m. $k = 1{\cdot}25$ m.m. $W = 110$ grms.

The weights in the two cases are thus nearly proportional to the lengths, Bunge's being slightly heavier in proportion. The cause suggested at the last meeting of the superior sensitiveness of Bunge's balance, namely, that the beam was lighter than that of other balances out of proportion to its length is, therefore, not the correct explanation.

The real reason is that the values of h and k are so enormously smaller in Bunge's balance than in the balances in ordinary use. The formula for the sensibility, viz.:—

$$\frac{a}{\sqrt{Wk + 2Ph}}$$

gives for Bunge's balance with the above data a sensibility ten or twelve times as large as that of the Kleiner balance, owing to this great decrease in the value of k.

The phrase used in the prospectus of Bunge's balance, that, *other things being equal*, the sensibility of a balance varies inversely as its length, has been supposed to contradict the ordinary view. The apparent contradiction lies in the fact that in the ordinary theory the phrase, "other things," means the values of W, P, h, k, while in the prospectus of Bunge's balance it means merely that the times of oscillation of the two balances compared are the same.

Referring to the formula for the time of oscillation of the balance which ought to have been given in the former note as—

$$\sqrt{\frac{2Ph + Wk}{Wk'^2 + 2Pa^2}}$$

where k' is nearly proportional to a, it is clear that the times of oscillation of any two balances are nearly proportional to the values of $\sqrt{\frac{k}{a^2}}$ for those two balances.

Consequently, if the beam of one be three times as long as that of the other, in order that the two balances may swing in the same time, the value of k for the longer balance will have to be nine times its value for the smaller; and if the weight of the larger be assumed to be three times that of the smaller, the sensibility of the larger will, by the formula $\frac{a}{Wk}$ assuming h in both cases to vanish, be one-ninth only of that of the smaller.

The writer regrets that in the former note the vertical lines of the diagram were not engraved perpendicularly to the horizontal ones, and that by an error, for which he is solely responsible, the same letter D was used to represent two points in the diagram. This will, he believes, cause no confusion if the attention of the reader is drawn to it at once.

* Read before the Newcastle-upon-Tyne Chemical Society, February 24, 1876.

SOME NOTES ON ANILINE-BLACK.

By S. CABOT, Jun.

There has been much discussion, in late years, upon the subject of aniline-black, both as to its technical application, and with regard to its chemical properties and formula.

My experiments upon the latter part of the subject lead me to believe that, as ordinarily seen upon cloth, aniline-black consists of a salt, or perhaps a mixture of salts, of a number of organic acids of a *red* colour, combined with a base of a greenish colour.

This base I believe to be quite similar to rosanilin in its chemical constitution, but not so strong a base. Like rosanilin, however, it contains (if freed from the acids mentioned above), I believe, *no* oxygen. It can combine weakly with mineral acids, and I may at some future time be able to discover its atomicity through means of this fact.

The red and purple-coloured acids, on the other hand, appear to be oxidised products; some of them, like indigo, may be reduced by the action of grape sugar and alkali, and are *reoxidised* by contact with the air.

In the ordinary methods of making aniline-black, *i.e.*, by the action of chloric acid upon aniline oil, large quantities of ammonia salts are found which remain in the filtrate, as may be easily seen by boiling the same with an alkali. This fact proves distinctly that the black itself must contain less nitrogen and less hydrogen than the aniline from which it is made.

And now with regard to the practical part. It has long been a great "desideratum" to obtain a *steam* aniline-black that was sufficiently good and cheap, and did no injury to the fibre. Many printers, knowing that acetic acid was a volatile acid, and not of great use in steam colours, have attempted to substitute it for other acids in the printing of this black, with *absolutely* negative results. I have shown by experiment that the cause of

this ill success is the formation of *acetanilide*, upon which the oxidising agents have not the effect desired. I believe in the case of the use of tartaric acid the same difficulty is sometimes to be experienced through the formation of a similar compound in which one of the hydrogen atoms of the aniline is replaced by the acid radicle of tartaric acid. Where chlorate of potash is used, however, this tendency is partly counteracted by the great tendency to form the insoluble bitartrate of potash.

The only steam aniline-blacks that appear as yet to have any great technical value are those made with ferro- or ferricyanide of aniline in connection with a chlorate.

The great step which should next be made in the preparation of this colour, is the introduction of the use of more soluble chlorates than that of potash—for instance, that of soda. Much inconvenience would thus be avoided, from the crystallisation of the chlorate of potash in the colour while printing, and the consequent destruction of both "doctors" and "rollers." It would also render possible the use of much stronger solutions of chlorate, which will be of great use in steam colours.—*American Chemist.*

ON THE ESTIMATION OF PHOSPHORIC ACID IN FERTILISERS.

By ALBERT H. CHESTER, E.M.

In testing some samples of raw bone for phosphoric acid, I tried a method by R. Warington, given in the second supplement to "Watts's Dictionary," with such good results that I thought it worth while to make a comparison between it and the method by molybdate of ammonia. To distinguish it, I shall speak of it here as the citric acid method.

Three different samples were tried by each method, giving the following results:—

	Weight taken.	Molybdate method, per cent P_2O_5.	Citric Acid method, per cent P_2O_5.
No. 1	1 grm.	22·00	22·05
„ 2	½ „	3·68	3·74
„ 3	1 „	18·73	18·77

The first method was worked with extreme care, every precaution being taken to insure accuracy, so we may unquestionably use the citric acid method for all commercial analyses, as the results, though uniformly higher, are certainly not enough out of the way to impair the value of the work. To insure such accuracy certain precautions must be taken, so the method is here given in detail.

The ground bone is first dissolved in hydrochloric acid, and the solution nearly, but not quite, neutralised with ammonia. Lime is then precipitated hot with ammonic oxalate, and allowed to stand for several hours. The supernatant liquid is then decanted through a filter, and the precipitate washed once, by decantation with hot water. It is then dissolved in as little hydrochloric acid as possible, and re-precipitated by carefully adding ammonia nearly to neutralisation, when it can be filtered and washed as usual. This final precipitate of calcic oxalate is perfectly free from phosphoric acid, and the filtrate from lime. A sufficient amount of citric acid to keep in solution any iron and alumina that may be present is then added, and afterward ammonia is added to alkaline reaction. For bone, the amount of citric acid needed is very small. Magnesia mixture may then be added to the ammoniacal liquid, and the phosphoric acid determined as magnesic pyrophosphate. In case the ammonia produced a precipitate, it should be carefully examined to see whether it is the result of an insufficient amount of citric acid, or on account of the presence of magnesia in the sample; which last, of course, would make no difference in the final result.—*American Chemist.*

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, June 15th, 1876.

Professor GLADSTONE, F.R.S., Vice-President, in the Chair.

THE names of the visitors having been announced and the numbers of the previous meeting confirmed, the names of Messrs. E. H. W. Swete and C. Law were read for the first time. Messrs. Arthur Brownhill Cortis, George F. Thomson, John Heron, Charles George Matthews, George Evans, and Dr. Otto N. Witt were balloted for and elected after their names had been read for the third time.

The first communication, "*Chemical Studies*," was given by Prof. DEWAR. The first note was on a method of producing a vacuum by the absorption of gases or vapours. In one instance he had tried to remove the residual hydrogen by palladium, but as the tension of hydrogen-palladium at the ordinary temperature is 2 or 3 m.m., it was evidently inapplicable. He had met with better success by using bromine, and absorbing the residual vapour by means of carbon; it was merely necessary to boil off a small quantity of bromine in a tube so as to expel the air, seal it, and allow it to cool; the carbon, which is confined to a small portion of the tube by a constriction, then absorbs the residual vapour so completely that the electric discharge gives very broad striæ, which are symmetrical at the two poles, a sign of a very good vacuum. It is curious that at ordinary temperatures the spectrum of the discharge gives no bromine lines, but only carbon lines, due to a trace of carbonic anhydride; when the carbon is heated, however, the bromine lines make their appearance. Chlorine or carbon bisulphide may be substituted for bromine. The author had found the perfection of the vacuum proportional to the heat developed by the absorption of the vapour by the carbon. He also exhibited some exhausted tubes, containing phosphorus, which had been partly exposed to the light; here the phosphorus vapours had condensed and crystallised on the glass in the polymerised state. After some remarks on the latent heat of dissociation of ammonium carbamate, which he had found by experiment to correspond very closely to that required by the dynamical theory of heat, he described a method by which he had determined the latent heat of the formation of ozone from oxygen; this was done by passing it through a solution of hydriodic acid, observing the heat developed, and making a correction for that due to the decomposition of the hydriodic acid. It was found to be between 5000 and 6000 units.

The Chairman having thanked the author,

Dr. ARMSTRONG gave a short account of his "*Researches on the Reduction of Nitric Acid and on the Oxides of Nitrogen* (Part I. *On the Gas Evolved by the Action of Metals on Nitric Acid*)," made in conjunction with Mr. Ackworth. After referring to the statements in the text-books, and reading extracts from Odling and from Gmelin, as representing the present state of our knowledge of the subject, which was very imperfect, from the fact that the experimenters had merely considered the qualitative composition of the gas, and not the relation of the amount of gas to the metal taken, he stated that it was now universally admitted that the first action of the metal on nitric acid was that represented by the equation—

$$R'' + 2HNO_3 = H_2 + R''N_2O_6,$$

and that the hydrogen at the moment of its liberation acted on the excess of nitric acid, producing either nitric or nitrous oxide or free nitrogen. The theoretical amount of gas per unit of metal, R'', dissolved being 14920 c.c. for NO, 5595 for N_2O, and 4475 for N. The method of experimenting adopted consisted in dissolving a known weight of the metal in excess of acid, *in vacuo*, carefully

collecting the evolved gas by means of a Sprengel pump and then measuring it. The results were exhibited in a series of tables showing the temperature, strength of acid, total amount of gas, percentage of NO, N_2O, and N, also the c.c. of gas per unit of metal, which never exceeds that required by theory. With copper the amount of NO is comparatively large, although the presence of cupric nitrate in large quantity exerts a considerable influence on the result, increasing the amount of nitrous oxide. With zinc the N_2O obtained is comparatively large, and, as with copper, the presence of much zincic nitrate increases it. In the case of cadmium and magnesium the former yields less N_2O than zinc, whilst the latter gives more, showing that cadmium is less active and magnesium more active than zinc. Tin yields chiefly N_2O. Nickel differs totally from iron in its action on the acid; the result being chiefly N_2O with the latter, NO with the former. It was found that chemically pure nickel obtained by reduction in a current of hydrogen, gave off hydrogen when dissolved in nitric acid; this was most probably occluded hydrogen. Silver, lead, and thallium were also tried, The authors especially call attention to the fact, clearly shown by these results, that the action of the hydrogen molecule differs greatly in its action on the excess of nitric acid according to the metal by which it is liberated.

Mr. C. T. Kingzett then read a paper "*On an Alkaloid Obtained from Jaborandi, its Platinic Compound, and their Formulæ.*" The alkaloid was obtained from the aqueous extract of the plant by precipitation with phospho-molybdic acid and the precipitate decomposed by baryta, or the extract was concentrated by evaporation, mixed with alcohol to throw down albuminous matters, &c., and after treatment with ether and ammonia extracted with chloroform. Although no crystalline hydrochloride of the alkaloid could be obtained, the platinic compound forms distinct reddish yellow octahedral crystals of the formula $C_{23}H_{35}N_3O_4,2HCl,PtCl_4$.

The Chairman having thanked the author, gave a short abstract of a paper by himself and Mr. A Tribe, on "*The Simultaneous Action of Iodine and Aluminium on Ether and Compound Ethers.*" The authors find that although ether is not affected when boiled with aluminium and aluminic iodide, yet when treated simultaneously with iodine and aluminium a powerful action takes place, the products being ethylic iodide and aluminic iodo-ethylate:—

$$3(C_2H_5)_2O+Al_2+I_6=3C_2H_5I+Al_2I_3(C_2H_5O)_3.$$

The iodo-ethylate may readily be obtained in a state of comparative purity by treating alcohol with aluminic iodide and aluminium, as shown in the equation,—

$$6C_2H_5O,H+Al_2I_6+Al_2=2Al_2I_3(C_2H_5O)_3+H_6.$$

It is a brown non-crystalline substance. The authors have also examined the action of iodine and aluminium on ethylic and amylic acetate, and find that the products are ethylic and amylic iodide and aluminic acetate, the reaction being—

$$6C_nH_{2n+1}.C_2H_3O_2+Al_2+I_6=6C_nH_{2n+1}I+Al_2(C_2H_3O_2)_6$$

The next paper was "*On some Compounds of Antimony Pentachloride with Alcohols and with Ether,*" by Mr. W. Carleton Williams. In order to prepare these compounds the pentachloride is cautiously mixed with the alcohol, taking care to avoid rise of temperature, and the product purified by crystallisation from alcohol or ether. They are hygroscopic, readily soluble in alcohol or ether, and are decomposed by distillation or by the action of water. The methyl alcoholate, $SbCl_5,CH_4O$, forms pale yellow plates melting at 81° C.; the ethyl alcoholate, $SbCl_5,C_2H_6O$, crystallises in long colourless needles, which fuse at 66° C.; the amyl alcoholate is also a white crystalline body, whilst the ether compound, $SbCl_5,C_4H_{10}O$, exists as a finely divided greyish white crystalline powder, which melts at 68° C., and decomposes slowly at the ordinary temperature, rapidly at 70° C.

A paper by Prof. J. W. Mallet "*On the Volatility of Barium, Strontium, and Calcium*" was then read. The author has ascertained by a series of carefully made experiments that when lime, baryta, or strontia are heated in contact with metallic aluminium to a very high temperature in a carbon crucible, it suffers an appreciable loss of weight, in some instances to the extent of more than 3 per cent, indicating that the alkaline earth must have been partly reduced and the metal volatilised. This supposition is confirmed by the observation of the flame of the carbon monoxide which is given off, the characteristic lines of the metals being distinctly visible when it is examined with the spectroscope.

The next communication was "*On the Action of Chlorine on Acetamide,*" by Dr. E. W. Prevost. It gives rise to two substances, one of which melts at 68° C. and the other at 129·5° C. They both crystallise in colourless needles, but the author was not able to deduce any satisfactory formula from the analytical results.

In a "*Note on the Perbromates*" Mr. M. M. P. Muir corrected his former statement that perbromic acid may be easily prepared by the action of bromine on an aqueous solution of perchloric acid (Kämmerer's process). His subsequent attempts to prepare perbromic acid in this manner having been invariably unsuccessful.

The last paper was by Dr. J. G. Blackley "*On a New and Convenient Form of Ureometer.*" In it he gives a description of a simple form of apparatus analogous to Russell and West's ureometer which is exceedingly convenient for clinical purposes, the method consisting in measuring the amount of nitrogen evolved on decomposing urea by sodium hypobromite. After making the correction, pointed out by Russell and West, the experiments made with a view of testing the apparatus gave very concordant and satisfactory results.

The Chairman having thanked the authors in the name of the Society adjourned the meeting.

NEWCASTLE-UPON-TYNE CHEMICAL SOCIETY

General Meeting, March 23rd, 1876.

John Pattinson, President, in the Chair.

The minutes of the last meeting were read and confirmed.

Messrs. S. B. Malcolm and H. M. Habinshaw were unanimously elected members.

The name of Mr. N. H. Martin was read for the first time.

Mr. B. S. Proctor read a paper on "*The Effect of Flexibility on the Working of Chemical Balances.*"

Departure of Dr. Lunge.

The President said they were all aware that a prominent member of the Society was going to take his departure from amongst them, having been appointed to a Professor's Chair in the Polytechnic School of Zurich—he meant Dr. Lunge. Dr. Lunge had been a most active member of the Society from its commencement. He acted at one time as its Secretary, and for many years furnished very interesting abstracts from foreign journals of chemical matters of interest to members in this district. Dr. Lunge had also contributed a great number of very interesting papers, and had filled with great distinction the office of President of the Society. Under these circumstances, it would be wrong to allow him to pass away from their midst without expressing to him their sense of the obligation they were under for his many useful papers and duties in connection with the Society, and wishing him God speed in his new undertaking. He believed Mr. Swan had prepared a resolution on the subject.

Mr. Joseph Swan said he thought it would probably meet the wishes of the Society if it were practicable, and in accordance with its rules, to elect Dr. Lunge an honorary member of that Society.

The PRESIDENT believed there was nothing bearing on it in the rules, but they could make a rule.

The SECRETARY—We can make a precedent.

Mr. SWAN said, believing this would be the feeling of the meeting, he moved the following resolution:—"That this meeting congratulates Dr. Lunge on his election to the Professorship of Chemistry in the Polytechnic School of Zurich; and in view of the consequent severance of his personal connection with the Newcastle Chemical Society, deems this a fitting occasion for acknowledging and placing on record its high appreciation of the services rendered by Dr. Lunge both as a principal member of the Society during the entire period of its existence, and as a frequent and most able contributor to its proceedings." He felt sure that he need not add to the resolution a single word to commend it to the members; for he was uttering what was generally felt when he said they were all deeply indebted to Dr. Lunge for his long, painstaking, and valuable services rendered to the Society.

Mr. GLOVER rose with great pleasure to second the resolution. He could bear testimony to all Mr. Swan had said in relation to Dr. Lunge's efficiency both as Secretary and President, and as an ordinary member of the Society. They had reason not only to respect Dr. Lunge's talents and ability, but those who new him best could bear testimony to his worth as a man. On these grounds he begged leave to second the motion.

The motion was then put and carried unanimously.

On the motion of the same gentlemen, Dr. Lunge was unanimously elected an honorary member of the Society.

Dr. LUNGE said he should not attempt to express the feelings which at that moment were uppermost in his mind, because he would have to make a long speech, and he ought not to inflict it upon them, looking at the business before them, and also because he could not say all he felt for that very unexpected honour. He had never had any other idea than to remain an ordinary member of the Society for the rest of his life. That he should have been honoured by being elected the first honorary member of the Society had never for a moment entered his mind, and he could assure them he appreciated it to its full extent; and he appreciated almost more the kind words which the mover and seconder of the resolution had spoken about him. He could say with the utmost sincerity that many of the pleasantest hours he had spent during the nearly eleven years he had been in this part of the country had been spent in that Society—in that very room—and in the intercourse he had had with many of his scientific brethren. He was going abroad, as they knew, but he should never cease to be an Englishman; because, as they knew, he was an Englishman by adoption. Nor should he ever cease to be a member of their Society—not only in name, but, he hoped, also in sympathy. He hoped his contributions of papers were not at an end, but that he would now and then still contribute. He begged to tend them his sincerest thanks, and more especially to the mover and seconder, for the great honour which had been bestowed upon him.

The Explosion in Grey Street.

Mr. FREIRE-MARRECO—As a good many versions of the accident in Grey Street have been circulated, some of them exceedingly wild ones, and as in some respects the explosion itself was rather interesting, I thought it might, perhaps, not be altogether amiss that we should have some short account of it recorded in our "Transactions." Without going into detail as to all the evidence that has been collected on the subject, I need not remind anybody that there was an explosion in Grey Street, close to the Bank of England, and a tolerably severe one. With regard to the explosion itself, the only point of special interest was the direction the sound-wave took, which was very well marked. A certain amount of damage was done on the ground floor of the Bank; the sound-wave seems to have crossed the street, and to have damaged the first-floor windows on the opposite side. It was then reflected very clearly and distinctly, so as entirely to miss the *first-floor* windows of the Bank, and scarcely to leave a single window unbroken in the top storey. That is all the interest attaching to the explosion itself. As to the cause, it seems perfectly clear that on the morning of the explosion a gas bag—which was supposed by the sender to be an oxygen bag, but which in reality was that which had been used to contain coal gas for the lime light—was sent to be filled, and was returned with a message that it was the wrong bag. The sender had in the meantime, probably supposing he had still got hold of the hydrogen bag, put coal gas into the real oxygen bag. We can hardly say very accurately what quantity he put in; but I should say, putting the different accounts together, the probabilities are that he had somewhere about 2 cubic feet of explosive mixture in the bag. Of course, whether it was mixed at all accurately in the proportions necessary for explosion, we can only speculate. The accounts of the principal actors in the filling of the bag are very discrepant; in point of fact, they contradict each other flatly in one or two respects; but on the balance of evidence, these are the conclusions one can hardly help coming to.* Now we have this boy started with the bag—and it seems to have been rather a leaky one—down Grey Street; and, as we all know, he had got as far as Messrs. Reid's shop when the explosion occurred. I was at first inclined to think that the boy, being possibly an amateur chemist, and knowing there was gas in the bag, had been experimenting with a lucifer match on his own account, the more so as the police found lucifer matches in his pocket. But one witness, who picked him up immediately after the explosion, says he watched him for some little distance down the street, and is quite certain that he did not touch the bag in any way except carrying it, and did not light it, and did not seem playing any tricks with it. Then the difficulty arises—how did it go off? Because, of course, the suggestion as to concussion by its falling on the pavement—the boy says he dropped it on the pavement to rest himself, being tired—is a perfectly absurd one; and so are one or two others which have been suggested. But, luckily, we have another witness, who says he saw a man come up just behind the boy with his pipe lighted, and throw away the match with which he had apparently just lighted it. This witness says he saw the match fall, still red, towards the bag, and the explosion immediately followed. So that, after all, it was no very extraordinary circumstance chemically which brought about the explosion. But the point of interest seems to be the rather long train of coincidences which was required. First, you get a man who does not know much about the management of lime lights to make an explosive mixture in a gas-bag; then, that gas-bag has to be a leaky one; then the leaky bag has to be placed on the pavement; and last, not least, some one has to light his pipe and throw away the match. The evidence seems to show very clearly that all this did occur, and I think the conclusion to be drawn from it is that it is very unlikely the same train of circumstances will ever come together again—at least in Grey Street. The violence of the explosion can be judged of from the specimens on the table; these are the only two pieces of the bag which we have been able to get hold of, and this little piece, I believe, was projected through one of the top windows of the Bank, so that the explosion must have been a pretty violent one. There arises naturally the question of how far the accident could have been prevented. I don't know that it could have been prevented as long as you have gentlemen dealing with lime-lights, one of whom says his usual practice is, "I first turn on my jet of oxygen and light it; when that has warmed the lime sufficiently, I turn on the common gas. I use my own judgment;" and how far his own judgment is to be relied upon I think we can all of us see. Then we have the other manipulator of the gas-

* I am indebted to Captain Nicholls for an opportunity of examining the evidence taken by the police authority.

bag, who says he filled it partly with coal gas; "that I sent down to the dealer; I thought he would put the oxygen into it and mix it. I am not acquainted with the management of experimental gases;" and I think we shall all endorse his description of himself. These are all the points of interest in the explosion, but I thought it as well that we should have some short account of it in our "Transactions."

The PRESIDENT said he was sure they would all join in thanking Mr. Freire-Marreco for his interesting account of this explosion.

Mr. GLOVER thought the Society ought to bear its testimony to the fact that the authorities of the town should have some control over the retailing of such a dangerous mixture as that of oxygen and hydrogen.

Mr. JOSEPH SWAN—I think it ought in fairness to be said that such a mixture of gas was probably never in Grey Street before, and that the likelihood of its being in Grey Street again is extremely remote. It is entirely unusual to make a mixture of oxygen and hydrogen. Formerly, as every chemist in this room knows, it was a common practice to make a mixture of hydrogen and oxygen, and burn the two gases from one jet; but it is long since that practice was abandoned, and now the regular course is either to use two bags—one containing coal gas and the other oxygen—or to use only one bag, oxygen, the other gas being taken direct from the main; and this latter is the general practice.

(To be continued.)

CORRESPONDENCE.

ORGANISATION AMONGST CHEMISTS.

To the Editor of the Chemical News.

SIR,—In an article in *Nature* of the 8th inst., "On the Organisation of the Profession of Chemistry," I find the following:—"But examining bodies, and bodies that issue certificates to those who pass their examinations, are ready to hand."

I have been surprised, in following the correspondence that has of late appeared in the CHEMICAL NEWS on the above subject, to observe that attention has not been turned to what I should have considered the most natural source from which aid might be expected. I refer to the Royal College of Chemistry, South Kensington—an institution *established and supported by Government* for the furtherance of chemical science. One of the ablest chemists in the country presides over this Institution, aided by an able staff of assistants, and with every facility at his disposal either for the preparation or examination of candidates for the chemical profession.

Here is the establishment for which we are casting about ready formed to our hand, wanting but the addition of a few more Professors to form an Examining Board, and which could have no more legitimate object than the present.

Being a Government and not a private institution, we might reasonably look for an impartial exercise of the responsible duties required in the present case; and it has been a matter of wonder to me that it has not come forward voluntarily to offer its services.

I can quite go with all that has been said by your correspondents as to the crying need there is to have the profession placed on a proper footing, and could recount many anecdotes of the low estimate set on our services far surpassing those given by your correspondents. The two following will, however, suffice:—

The manager of a large iron works, lately turned into a company, sent for me to ask my terms for complete analyses of iron ores, as some members of the board had actually ventured the hitherto unheard-of suggestion that it might be well to have the ores, which were being bought in thousands of tons on the faith of the seller's analysis analysed for a check on the quality. As a large number of analysed were promised, I abated my usual charge of £3 3s. to £2 2s., knowing that a neighbouring analyst was ready to make *single* analyses at this unremunerative rate. The enlightened manager seemed much surprised, as he had thought £1 1s. would have been ample remuneration.

But even this is surpassed by a story lately told me by an eye-witness. A man walked into a well-known laboratory one day with a sample of gold quartz from North Wales. There being something suspicious in his manner, he was told that the fee would be so much; when he replied, "Oh, I thought you would have done it for the value of the gold in it."

What between ignorance on the part of employers, and competition on that of unqualified practitioners, it is high time that those who are properly qualified should protect themselves; and I trust that the matter will not now be allowed to drop until such protection is obtained. With this view I have made the above suggestion.—I am, &c.,

A R. S. M.

Chemical Laboratory, Birmingham and Edgbaston Proprietary School, June 15, 1876.

THE CHEMICAL SOCIETY.

To the Editor of the Chemical News.

SIR,—It would appear that the Chemical Society, like almost every other similar scientific society, has a large number—perhaps nine-tenths—of inactive members, who contribute nothing but their subscriptions; and we may fairly infer that their subscriptions are of considerable importance when taken collectively. It appears to me that the qualification necessary for Fellowship is simply that the candidate shall be a "decent fellow," and one who is likely to put out his hand to help the general objects of the Society as far as he is able.

If greater restrictions had been enforced for admission to the Fellowship from the first, the power for active good to the public would, I think, have been cramped seriously for want of funds, although the scientific position of the Society would doubtless have been higher than it is.

I would suggest a slight alteration in the rules, which would, no doubt, eventually raise the position of the Fellows to what they would wish it to be without throwing any check on the funds, which would at present possibly cause serious trouble.

That all candidates shall be, when first proposed, elected only as Associates, having every privilege equal to the Fellows except as regards official service. That any Associate shall, after contributing to the Society a paper containing the results of his own original research, be at once eligible for election to the Fellowship, and that his election shall be valid if three-fourths of the members present vote in his favour.

Fellowship of any scientific society to be obtained only by examination, would, in my opinion, be a farce, and would immediately reduce the admissions to about zero; and any examination for professional chemists ought to be conducted by a separate examining body having no official connection with the Chemical Society. I would suggest that all professional chemists shall pass any examination necessary at the College or University at which they were educated.

The Chemical Society certainly has nothing to do with this matter; its meeting-room is a rallying point for friends, mutually interested in the same subject, to meet and exchange ideas. If any member has no ideas to exchange, but gives help other ways to the best of his ability, there is no reason why he should be badly treated; and the contribution of original scientific work might, without causing any ill feeling or difficulty, make a strong mark between the two matters which go to make success—*brains* and *money*.—I am, &c.

T. F.

To the Editor of the Chemical News.

SIR,—When lions enter the arena, the work should be worthy of kings. You may therefore expect, Sir, it was with eagerness that I read in your pages the letters on the Chemical Society by Profs. Maskelyne and Roscoe. But conceive my disappointment in finding Prof. Maskelyne merely reiterating, with somewhat more of detail, the story told to us a few weeks since by Mr. Warington, and so strongly condemned by the majority of your correspondents. Instead of likening our Society to what these gentlemen term the sister societies of Geology and Astronomy, it would have been more to the purpose had they reminded us of the fierce battle which raged, not so very long ago, in the oldest of learned Societies, between money and merit; in which the latter, to the Society's honour, came off to a great extent the victor. The reformers in those days were doubtless sneered at as much as Prof. Roscoe has considered it his duty to sneer at the men who are striving to drag the Chemical Society out of its present miserable condition. But let us hear the charge made against us. Prof. Roscoe has a worthy friend—a science teacher—whom, he tells us, was rejected for the purpose of "improving the Society." The words between inverted commas I take for an attempt at irony. If not, we are on this point in perfect agreement. Now it must be known that the title "science teacher" may be used by any one who proves, to the satisfaction of the Science and Art Department, that he possesses a third rate book knowledge of any one of about twenty subjects, more or less scientific. "Science teacher," therefore, not necessarily affording any evidence of chemical knowledge, should not be taken as a qualification for the Fellowship of the Chemical Society. But the Professor may aver, "I certified to my friend's eligibility when I signed his paper." Personally I entertain a just respect for Prof. Roscoe, but since he considers a chemical qualification unnecessary, and I do, for the Fellowship of the Chemical Society, I can attach no value to his signature when I find it on a candidate's certificate. I trust this will be taken as a sufficient explanation of our "tactics."

Mr. Hartley has once more done good service to the cause in collating some of our ideas and expressions of opinion, and in giving us such a graphic description of the process by which candidates get signed up. We earnestly recommend the unconverted to read this gentleman's simple confession.—I am, &c.,

TWIG.

To the Editor of the Chemical News.

SIR,—The correspondence which has for some weeks been raging on the above subject in the columns of your paper will, I trust, have a practical result in the adoption of the only course which can, in my opinion, prevent anything like improper admission to the Chemical Society.

It is much to be regretted that indiscriminate blackballing was ever resorted to; it can in the end do no real good, and will certainly prevent application for membership on the part of many men who would be an acquisition. It is an illogical and underhand way of attempting to purify the Society, and success on the part of the infallible clique who have thus set themselves up as the judges of candidates of whom they know, in most cases, absolutely nothing, and whom they reject simply because they are not professional chemists, probably means the disruption of the Society. At no time have we been looked upon as simply a body of professional chemists, and I most sincerely trust that no such time will ever come. As Mr. David Howard and other gentlemen have pointed out, much good work has been done by "the dilettanti in the true sense of the word," and any attempt to exclude them and convert the Society into a trades union of chemists, cannot but prejudicially affect the advancement of chemical science, and the welfare of the Chemical Society.

No one doubts that some unfit men have gained admission for the sake of thrusting the F.C.S. before the eyes of the public in advertisements, &c., but if every Fellow would faithfully fulfil the promise he makes on entering the Society, to do all in his power to promote its interests and the good of the science, and would systematically refuse to give his name to a would-be candidate without knowing that he really was entitled to become a member, it is my firm conviction that this most unfortunate state of things would never have been brought about. Here it seems to me is the proper and legitimate means of keeping the Society as it should be, and any course such as that lately followed by the misguided few, will certainly cause the Society to afford a new illustration to the old saying concerning a house which is divided against itself.—I am, &c.,

G. W. R.

Liverpool, June, 20, 1876.

To the Editor of the Chemical News.

SIR,—It behoves all readers of your paper to have an appreciation of the reasoning by which the rejection of certain candidates for the Fellowship of the Chemical Society is defended. I notice, in your last issue, Mr. Howard asking whether such men as Dalton (mathematician), Herschel (organist), Murchison (fox-hunter), Thirlwall (clerk in holy orders), Grote (banker) are to be rejected. In reply, I may say I feel certain they would and ought to be rejected if nothing more were known of them than what is conveyed in these words; and also that these men would not have been so foolish as to put these things down as *qualifications* for the Chemical Society.—I am, &c.,

BEE.

To the Editor of the Chemical News.

SIR,—After the summing-up of Lord Chief Justice Maskelyne (begging his pardon for the liberty), it is difficult to see what more can be said upon the matter. His letter is an example of the come-and-let-us-reason-together method, that is eminently worthy of copying; conciliatory and gentlemanly in a high degree, but calm, clear, and practical.

But will Masters "Twig" and "Nuntius" take a word in a quiet way from a youngster like themselves? The Chemical Society is *not* a *close* Society, and is *not* an examining board, and was never made for such; and any effort to take an established and respected society of its dignity and position, and make it such by force, *after* they themselves have entered it, is very like the manner and custom of a bird that says a good deal and doesn't do much, called the cuckoo. If the nest doesn't suit them, it is possibly because it was not made for them—solely. So let the young Fellows take heart; there are plenty of "twigs" to build another nest—not, perhaps, so good as the old one, but as strictly exclusive as an oyster's home.—I am, &c.,

F.N.S.A.

June 19, 1876.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Bulletin de la Societe Chimique de Paris, No. 10, May 20, 1876.

Composition of Native Peroxides of Manganese.—T. L. Phipson.—The determination of the peroxide alone (as ordinarily performed for commercial purposes) does not suffice to ascertain the value of this substance. Certain samples contain fluorine and phosphoric acid in

very considerable proportion, and also a small quantity of arsenic acid. A peroxide of manganese much used in England, if digested for twenty-four hours in very dilute nitric acid, yields to the solvent a large quantity of phosphate of lime, a little arsenic acid, traces of nickel and cobalt, much iron, and traces of indium. From this liquid sulphuretted hydrogen separates a little lead with arsenic acid and traces of copper. The filtrate mixed with excess of acetate of soda and sulphide of ammonium deposits much phosphate of iron with traces of indium, nickel, and cobalt, and the filtrate from this precipitate contains much phosphate of lime. Boiling hydrochloric acid leaves a reddish residue containing quartz and silicate of manganese (Rhodonite).

Fraudulent Colouration of Wines.—M. Arm. Gautier.—An exhaustive and voluminous paper of which we have here only the first portion. The fraudulent colouring matters taken in the order of their importance are magenta—arseniferous drugs being sometimes employed—cochineal, the Chinese mallow (*Althæa rosea*), elder-berries, and extract of indigo. The berries of *Phytolacca decandra* have been disused in the South of France on account of their violent and irritating purgative action.

Atomicity as a Principle of Classification.—M. Edme Bourgoin.—Reserved for insertion in full.

Imidosulphonic Acid.—M. E. Berglund.—The author describes the free acid $NH.2SO_2H$, and its neutral ammoniacal, potassic, and barytic salts; its basic potassic, sodic, barytic, strontic, calcic, argentic, and plumbic salts, and a series of double compounds in which mercury is present.

Preparation of Hæmatinon.—M. R. Kayser (*Poly. Centralblatt*).—Hæmatinon is a flux of a fine red colour formerly employed in mosaic work. The following proportions give the best results:—

Pure quartz sand	60 parts
Oxide of copper	10 ,,
Ferrosoferric acid	3 ,,
Calcined borax	10 ,,
,, soda	10 ,,

The mixture must be brought to a very high temperature, and then allowed to cool to dull redness, at which it is kept for some time. The red mass is generally covered with a green vitreous layer.

Use of Stassfurtite in the Preparation of Boracic Acid and of Borax.—M. G. Krause (*Berg. and Hüttenm. zeitung*).—Stassfurtite, which is a variety of boracite composed of $2Mg_3B_8O_{15}+MgCl_2$, and containing 62·57 per cent of boracic acid before being delivered to the market, is washed so as to remove the foreign salts, the proportion of which may reach 50 per cent. The ground ore is introduced into leaden troughs and reduced to a paste with water, heated, and the solution of the residual foreign salts drawn off through an opening fitted with wire gauze. It is again slightly washed with water, and the remaining mineral is heated with 300 kilos. of water and 150 kilos. of hydrochloric acid at 1·16 to 105 kilos. of the mineral. The acid solution on decantation and cooling deposits crystalline boracic acid, which is pressed in cloths, washed with water, and dried.

New Process for the Manufacture of Dextrin.—M. Anthon (*Dingl. Pol. Journ.*)—At present fecula in the separate state is exclusively employed in the preparation of dextrin, all that portion being wasted which is retained by the fibrous part of the potato or of the bran. To prevent this loss the author recommends the use of the entire potato dried and ground after being freed from its soluble principles by washing in acidulated or alkaline water. The fecula thus obtained is sprinkled with hydrofluosilicic acid (0·5 to 1 per cent of the weight of the fecula); it is then placed in a drying-room at 38° to 44° till there is no further loss of weight; the temperature is then raised to 70° to 75° till no loss occurs, and finally to 90°. The desiccation being thus complete the fecula, whilst still hot, is placed in large flat sheet-iron troughs which are introduced into large stoves heated to 100° to 125°. The transformation into dextrin is known to be complete when a sample taken out, on being cooled and moistened with cold water, adheres together in little glassy globules.

Characteristics of Eosine upon Stuffs.—M. R. Wagner (*Deutsche Industrie Zeitung*).—To distinguish eosin from saffranin and other colouring matters the most striking reaction is its inverse transformation by debromisation into fluorescein. Under the influence of sodium amalgam fluorescein is very readily recognised by its splendid uranium-green fluorescence of an extreme sensibility. But this reaction, indicated by M. Baeyer, requires a skilful hand. The following procedure is easy and certain. Collodion is coloured by all the dyes derived from aniline, by Magdala red and alizarin; eosin, on the contrary, is immediately decolourised by collodion. To detect it upon a tissue a drop of collodion is sufficient; if the tissue is dyed with eosin or methyl-eosin a white spot is produced.

Resorcin Black.—M. R. Wagner.—If to an aqueous solution of resorcin there is added sulphate of copper and then ammonia, enough to re-dissolve the precipitate first formed, a deep black liquid is obtained which dyes wool and silk black and which may possibly be used as ink.

Medicinische Jahrbücher Herausgegeben von der K.K. Society of Physicians, Jahrgang 1876, Heft ii.

This serial appears to be mainly devoted to anatomical and surgical subjects. There is, however, a paper by Dr. M. Abeles, of Carlsbad, on the "Saccharific Ferments in the Animal Organism." From a number of carefully conducted experiments the author concludes, in opposition to Dr. Pavy, that "A solution of glycogen injected into the circulation produces no greater secretion of sugar than does pure water. The subcutaneous injection of glycogen also occasions no excretion of sugar. Hence the blood has no saccharific power."

Reimann's Farber Zeitung, No. 17, 1876.

Aniline Colours in the Spectroscope.—By Dr. M. Reimann.—I have examined a series of aniline colours with the spectroscope in the hope of utilising this valuable instrument both for the determination of sophistications and for distinguishing shades. After some attempts I decided in favour of an instrument in which the image of a photographed scale is thrown upon that of the spectrum, which renders it possible to read off the darkening of the spectrum in degrees. The two coincident images were examined as usual through a telescope. In order to render it possible for anyone to repeat the following experiments I have determined some of the best known metallic lines in their position upon my spectral scale, which reaches from 1·0 to 15·0. Of the metallic lines examined the following took up the spaces given:—

Yellow sodium line	5·5	to 5·9
Red potassium line	4·9	5·0
No. 1, lithium line	3·9	4·2
No. 2, ,, ...	5·5	5·8
Green thallium line	7·2	7·5

The position of the spectral colours of the scale was as follows:—

The spectrum appeared black from	1·0	to 3·5
Red occupied	3·5	4·5
Orange	4·5	5·0
Yellow	5·0	5·8
Green	5·8	8·6
Blue	8·6	10·5
Indigo	10·5	12·6
Violet	12·5	15·0

The solutions of colouring matters under examination were diluted to 1 part in 10,000. In order to facilitate the repetition and control of the experiments as regards shades of colour, I have given, where it appeared needful, the position which the colour in question occupies in the first of Chevreul's circles (*couleurs franches*). The width of the slit of the apparatus was arranged so that the darkening of the spectrum was just distinct, which, with a little practice, is easily measured. It may be remarked that when coloured solutions are introduced that part of the spectrum appears dark—in most cases black—which shows the complementary colour of the dye under examination. Which this is may be ascertained in the well-known manner from the first circle of Chevreul's system. The three colouring matters first examined were magenta, eosin, and safranin :—

Magenta ; spectrum black 1 to 3·5, darkened 6·0 to 9·0.
Eosin ; black 1 to 3·8, darkened 7·2 to 9·0.
Safranin ; black 1 to 3·1, darkened 6·0 to 8·0.

A mixture of equal parts magenta and eosin showed the spectrum black 1 to 3·1 and darkened 7·3 to 8·5. A mixture of equal parts eosin and safranin gave a black spectrum 1 to 3·2, darkened 6·8 to 8·3. A mixture of equal parts eosin and safranin black 1 to 3·2 and darkened 6·5 to 8·0. The following colours were also determined :—

Colour.	Chevreul's name.	Black.	Darkening.
Nicholson blue, 4 B ..	B 2	—	1·0 to 4·7
,, ,, 5 B ..	B 4	—	1·0 4·7
Methyl violet, 3 B ..	B V 1	1·0 to 3·6	4·5 5·1
,, ,, 2 B ..	B V 3	1·0 3·5	4·7 5·4
,, ,, B ..	V	1·0 3·9	5·0 5·5
,, ,, R ..	V 2	1·0 4·7	5·7 6·0
,, ,, 2 R ..	V 3	1·0 4·4	5·3 5·9
,, ,, 3 R ..	V 5	1·0 4·0	5·8 6·0
Scarlet ruby, II. O O R	R O	1·0 3·3	5·6 6·7
Ruby, II. O R yellowish	R 4	1·0 3·9	5·9 7·0
Ponceau ruby, II. R RO	V R 3	1·0 3·6	6·2 7·0
Methyl green	B Ve 2	—	1·0 5·3
Iodine green	B Ve 4	—	1·0 5·9

No. 18, 1876.

In a leading article on the necessity of technological schools (Fachschulen) taken from the *Volks Zeitung* the remark is made that Germany is in the industrial arts far behind other nations, and does little but imitate. As a remedy Dr. Reimann suggests improved patent-laws and a new tariff. (It is very remarkable that at the very time when an attempt is being made to destroy our system of patent laws it should be recommended for introduction into Germany.) Coloured yarns, especially those dyed with magenta and other coal-tar colours, are often found partially discoloured or even bleached. This is due to their being wrapped in white paper containing an excess of chlorine. It would be preferable to wrap them in coloured papers.

Justus Liebig's Annalen der Chemie,
Band 181, Heft 1.

Dinitro Compounds of the Fatty Series.—Dr. Edm. ter Meer.—A lengthy essay ; unfit for abstraction.

Certain Bromo-sulpho-benzolic Acids.—Dr. W. Lenz.—A long paper, presenting no points of particular interest, and abounding in hypothetical formulæ.

Certain Compounds of Hydro-sulpho-cyanic Acid with the more important Cinchona Alkaloids.—O. Hesse.—The compounds described are those of quinine, cinchonidin, conchinin, and cinchonin.

Phenol Compounds.—O. Hesse.—The author points out that whilst phenol is an excellent test for ascertaining the quality of the cinchona alkaloids the latter may inversely serve as reagents for phenol. Certain salts of these alkaloids may find a similar application to that of certain bisulphites in the recognition and separation of aldehyds, and acetons.

Aricin and Kindred Substances.—O. Hesse.—Aricin, cinchovatin, and de Vriz's lævo-rotatory alkaloid when purified are identical with cinchonidin. Cusconin is the sulphate of cinchonidin.

Re-conversion of Triacetonamin into Diacetonamin and a Fifth Aceton Base.—W. Heintz.—Not adapted for abstraction.

Nitrogen and Albumen Present in the Milk of Women and Cows.—Dr. Leo Liebermann.—The author concludes that both in Brunner's and in Hoppe-Seyler's method a considerable part of the albuminoids escapes precipitation : Haidler's method, on the other hand, gives the total amount of the lacteal albuminoids, which may also be entirely thrown down by means of tannin. In addition to casein and albumen a third and distinct albuminoid body is present, but there is no nitrogenous body found in milk except such as belong to the albuminoid class.

Determination of Nitrogen in Albuminates.—Dr. L. Liebermann.—The author agrees with Seegen and Nowak that where an exact determination of nitrogen is required the method of Dumas must be adopted to the exclusion of that of Will and Varrentrapp.

Researches on the Biliary Pigments.—Dr. R. Maly. (Fifth part.)—Incapable of abstraction.

Remarkable Transformation of Normal Butyric Acid into Isobutyric Acid.—If a solution of normal butyrate of lime in water is subjected to the prolonged action of heat in a sealed tube it is converted into the corresponding isobutyrate.

Band 181, Heft 2.

Contributions to the Theory of Luminous Flames.—Dr. Karl Heumann.—The first portion of an extensive treatise. The author examines critically the various existing theories, and maintains that the views of Davy require to be enlarged and developed rather than rejected.

Milky Juice of Plumiera Acutifolia, and on Plumieric Acid.—A. C. Oudemans.—Not capable of useful abstraction.

Determination of the Atomic Weights of Cæsium and Rubidium.—R. Godeffroy.—The atomic weight found for cæsium is 132·557, or, in round numbers, 132·6. Bunsen, Johnson, Allen, and Mercer give in round numbers 133. The atomic weight of rubidium is 85·476, or, in round numbers, 85·5. The author describes in detail the methods adopted for obtaining the two bodies in a state of purity.

Preparation of Platinum-Black by means of Glycerin.—Milau R. Zdrawkowitch.—The author takes 15 c.c. glycerin at 25° to 27° B. and 10 c.c. potash lye at 1·08 specific gravity. The mixture is heated to a boil, and then 3 to 5 c.c. of solution of chloride of platinum are added drop by drop of the strength commonly used as a reagent.

Communications from the Laboratory of the University of Greifswald.—These communications consist of a paper on the action of bromine upon ortho-amido-sulpho-benzolic acid, by H. Limpricht ; one on ortho-bromo-sulpho-benzolic acid, by A. Bahlmann ; and one on metamido-sulpho-benzolic acid and bromo-sulpho-benzolic acid, by H. Beckurts.

Observations on Zirconia.—R. Hornberger.—The analogy of zirconium with silicium to be traced in many inorganic compounds does not extend to organic bodies. Oxide of zirconia cannot combine with alcohol radicals so as to form compound ethers in which it plays the part of an acid, as does silica in the silicic ethers. In contradistinction to silicium zirconium is electro-positive with organic groups of atoms.

A Criticism on the Researches of R. Maly on the Biliary Pigments.—J. L. W. Thudichum.—A controversial paper.

Action of Zinc Ethyl upon Acetaldehyd.—G. Wagner.—Not adapted for abstraction.

Moniteur Scientifique, du Dr. Quesneville, June, 1876.

Tempered Glass.—MM. Perry-Nursey, de Luynes, Tell, &c.—A long account of the various processes used for toughening glass. M. de la Bastie has proved that contrary to the opinion generally received tempering gives to glass a solidity far superior to that of annealed glass.

Ferments and Fermentations.—M. Ch. Blondeau. (Continuation.)—This treatise does not admit of useful abstraction.

Essence of Roses.—An account of the production of this perfume at Kezanlik in the Balkan chain. 16 kilos. or about 130,000 roses are required to produce 30 grms. of the essential oil. The yearly yield of the district is estimated at 2000 kilos. of oil, worth on an average 1000 francs. per kilo.

History of the Turkey Red Manufacture.—M. T. Chateau.—Unfit for abstraction.

Preparation of Pure Nickel from the Nickel of Commerce.—M. A. Terreil.—The author dissolves in 7 parts of aqua regia, evaporates almost to dryness, re-dissolves in water, separating the insoluble matter by filtration, precipitates the copper with metallic iron, peroxidises the iron, transforms the metals into sulphates, and lastly, precipitates the iron with carbonate of baryta and crystallises the sulphate of nickel.

Citric and Tartaric Acids.—Taken from the *Journal of the Society of Arts*.

Industrial Exhibition of Mulhouse.—An account of the opening ceremonials, festivities, speeches, &c.

Les Mondes, Revue Hebdomadaire des Sciences, No. 1, May 4, 1876.

Temperature of the Interior of the Earth.—From observations made on the Well of Sperenburg, near Berlin, M. Mohr concludes that at the depth of 5170 feet the increment of heat must be nil. A similar decrease of the increment of heat has been observed in the Artesian Well of Grenelle. Hence M. Mohr draws conclusions unfavourable to the Plutonian theory.

Nos. 2, 3, and 4, May 11, 18, and 25, 1876.

These issues contain no chemical matter.

No. 5, June 1, 1876.

Putrefaction Produced by Bacteria in Presence of Alkaline Nitrates.—M. Meusel.—The presence of nitrites in common water is due to bacteria when it contains nitrates, and organic bodies such as sugar, starch, cellulose, &c. Bacteria are the agents of the transmission of oxygen even when in chemical combination. It is probably by reason of the consumption of oxygen which they effect that these animalculæ are so dangerous to man. Nitrates are useful as manure, not merely in virtue of the nitrogen which they contain, but also by their oxygen, by means of which the bacteria destroy the cellulose.

The Radiometer of Mr. Crookes is already employed in photography to judge of the time necessary for the exposure of an object.

The manufacture of sea-weed charcoal is carried on on a large scale at Noirmoutiers, where more than 200 furnaces are constantly at work. The value of the charcoal is from 80 centimes to 1 franc per hectolitre. 100,000 kilos. of fresh weed give 20,000 kilos. of dry material, or 5000 kilos. of charcoal, which, when incinerated, yield from 3500 to 4000 kilos. of saline matter. Weeds which abound in potash, such as the *Laminaria*, contain more iodine than bromine. In *Fucus nodosus*, *vesiculosus*, *fructicosus*, &c., soda predominates, and bromine is much more abundant than iodine.

No. 6, June 8, 1876.

The Industrial Society of Mulhouse has celebrated its fiftieth anniversary. Delegates were present from the Academy of Sciences, from the Conservatory of Arts and Manufactures at Paris, the Industrial Societies of Rouen, Reims, Amiens, &c.

MEETINGS FOR THE WEEK.

SATURDAY, 24th.—Physical, 3. The following Apparatus from the Loan Collection will be exhibited and explained—Electric and Magnetic Apparatus by Prof. Petrochovsky, Mach's Apparatus for Lenses, Kerr's Apparatus for showing Effect of Tension on Polarised Light, &c.

TO CORRESPONDENTS.

F. Sonstadt.—A letter is waiting for you at our office.

C. W. Whittaker and Co.—You had better advertise for names of Prussian blue and ultramarine manufacturers.

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PHYSICAL SOCIETY.

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THE CHEMICAL NEWS.

Vol. XXXIII. No. 866.

THE CHEMICAL SOCIETY.

History is said to repeat itself. The correspondence which has been going on for the last few weeks in our columns shows that a somewhat widespread dissatisfaction exists in regard to the election of Fellows of the Chemical Society, the malcontents using the ballot-box to force matters to a crisis.

It will be remembered by many of our readers that nine years ago* we had to draw attention to a parallel state of affairs in the Chemical Society. Then, as now, certain members felt that the Fellowship of the Society was somewhat too easily acquired; then, as now, these dissentients thought it desirable that something should be done to restore to the initials F.C.S. the honourable prestige which they feared was departing from them; and then, as now, an anonymous minority of the Fellows adopted the expedient of indiscriminate blackballing in order to coerce the Council of the Society to follow a particular line of action.

Considering how exactly parallel the two cases are, it has been thought advisable to reprint the following report which was circulated among the Fellows of the Society in November, 1867: and it is hoped that the fair and impartial summing-up of the various arguments for and against may tend to allay the anxiety which some of the younger Fellows of the Society appear to feel that their interests and scientific status are less thought of now than they were a few years ago.

"CHEMICAL SOCIETY, BURLINGTON HOUSE,
"Piccadilly, W.

"*November* 11, 1867.

"Sir,

"At a meeting of the Council, held on May 16th, 1867, it was resolved, 'That a Committee of five be appointed to consider the by-laws relating to the election of Fellows, Honorary Members, and Associates, and to report to the Council.' It was further resolved, 'That the Committee consist of Mr. Crookes, Dr. Miller, Dr. Odling, Mr. Wanklyn, and Dr. Williamson.'

"Upon the presentation of the Committee's report at a meeting of the Council, held on November 7th, it was resolved, 'That this report be approved, and that a copy of it be sent to each Fellow of the Society.'

"We beg to append the report in question, and have the honour to remain,

"Your obedient Servants,

"W. Odling,
"A. Vernon Harcourt.
"*Hon. Secretaries.*

"Your Committee were appointed by a resolution, passed at a Meeting of Council, held on May 16th, 1867, in fulfilment of the intention which the Council announced to the Society in its anniversary report.

"As bearing upon the standard of qualification for admission to the Fellowship of the Chemical Society, your Committee, from replies they have received to a circular which they addressed to all the Fellows, and from conversations they have held with different Fellows whom they chanced to encounter, have ascertained the existence among the Fellows of the Society of two very distinct views as to its nature and purposes.

"Many Fellows appear to regard the Society as being by rights an association of eminent scientific men; and they accordingly look upon the Fellowship of the Society as a distinction which should be conferred only upon those who have given evidence of marked chemical proficiency, as, for example, by the production of some original memoir; so that the election of anyone as a Fellow of the Society should stamp him at once as being a well-trained chemist and competent investigator.

"In favour of this view it is urged that the initials F.C.S., appended to the name of any gentleman, seem to imply that his attainments have won for him a public recognition somewhat in the character of a degree; and that these initials ought to signify, in reality, that which they seem to imply, and which is indeed their proper signification.

"It is further urged that the Fellowship of the Chemical Society is essentially an honorary distinction, although from the ease with which it can be obtained, practically by any who choose, it is a distinction but little valued by the better sort. It is, however, eagerly sought after and obtained by men who are not perhaps altogether desirable—who certainly have no claim to the title of scientific chemists—and who, in some cases, do not even join the Society from any interest they take in chemical science, but solely with the view of parading a distinction to which their merits do not really entitle them.

"Moreover, from the circumstance that chemistry is pursued, not only as a science but also as a profession and trade, the right to append the initials F.C.S. possesses a sort of trade value, exceeding its cost, to mere trading or professional chemists; as suggesting that those who have the privilege of using these initials are better qualified men than their brethren who are not thus distinguished.

"From these causes, it is said, the Fellowship of the Chemical Society has gradually sunk in public estimation; and accordingly it is very desirable that something should now be done to restore, if possible, its original prestige.

"On the other hand, many Fellows are of opinion that the Society is merely an association of individuals, having joint but various interests in the progress of both pure and applied chemistry; that the object for which the Society exists is not to confer honour upon any individual whatever, but to promote the general advancement, distribution, and application of chemical knowledge; and that, as a general rule, men engaged in pursuits more or less dependent on or connected with chemistry, and taking a sufficient interest in chemistry to wish to join the Society should, unless personally objectionable, have every facility afforded them for joining it.

"In favour of this view, the preamble to the charter is adduced, and especially the following paragraph; whereas certain of our subjects 'did establish and are now members of a society known by the name of the Chemical Society, for the general advancement of chemical science, as intimately connected with the prosperity of the manufactures of the United Kingdom . . . . . and for a more extended and economical application of the industrial resources and sanatory condition of the community,' &c.

"It is further maintained that the Society, from its origin until the present time, has always been of a mixed rather than of an exclusively scientific character—that the present Fellows form quite as distinguished a body as have ever constituted the Society—and that many, at any rate, of the most distinguished individual Fellows do not feel themselves at all discredited by being associated as joint Fellows of the Society with men who are engaged or interested in chemical pursuits, but whose scientific or social position is inferior to their own.

"Moreover, of scientific as distinguished from purely professional societies, the Royal Society, it is urged, is the only one of which the Fellowship is conferred in recognition of eminent scientific merit—the special science societies being practically open to all students of and workers at their respective subjects, who may wish to be elected to their respective Fellowships. To limit the

* Vide Chemical News, vol. xv., pp. 229, 243.

Chemical Society then to eminent scientific chemists would be tantamount to making it the chemical section of the Royal Society, instead of allowing it to have a distinct function and character of its own.

"It is further urged that the circumstance of chemistry being to some extent a profession, so far from indicating the propriety of making the Fellowship of the Chemical Society an honorary distinction, rather contra-indicates it. For, independently of the difficulty, or rather impossibility, of withholding or conferring the honour without doing much injustice to individuals, the Society, by professing to choose out the most worthy, would naturally be held responsible for its choice, and identified more or less with the acts of each and all of its Fellows.

"Your Committee having given these different views their best consideration, are not prepared to recommend any alteration in the bye-law relating to the election of Fellows, which would have the effect of confining the Fellowship of the Society to strictly scientific men.

"But they think it may be advisable, although they have failed to elicit evidence of the admission of any significant proportion of unsuitable persons into the Society, to make some modification in the present bye-law, with a view to increase the security against the accidental election of undesirable candidates.

"They accordingly suggest that in future, or after a certain interval of time, the form of recommendation of a candidate, referred to in the first paragraph of the bye-law in question, shall be required to be signed by five instead of by only three Fellows of the Society, of whom three at least instead of only one shall be required to sign from personal knowledge; and further, that in the second line of the printed form of recommendation, the words 'Qualification or Occupation' shall be substituted for the words 'Position, Profession, or Occupation.'

"At present your Committee are not disposed to advise any alteration in the second paragraph of the bye-law, which requires three-fourths of the votes given to be in favour of the candidate, in order to effect his election. If, however, contrary to the anticipations of the Committee, any section of the Fellows should be found to make an improper use of this requirement, your Committee would then recommend that one or other of two courses should be proposed by the Council and adopted by the Society; that is to say, that the bye-law should be so altered as to render valid the election by a mere majority, or else that the bye-law should be temporarily abrogated, and during its abrogation the election of Fellows be delegated by the Society at large to a Committee appointed for the purpose.

THE NEW BILL FOR THE PREVENTION OF THE POLLUTION OF RIVERS.

THE Ministry has at last fulfilled its promise, and this eagerly awaited measure has been actually introduced. In what shape it will become law, if at all, lies beyond the scope even of an editor's prescience. But we may safely say that it deserves to pass; not that it fulfils all the reasonable expectations of the friends of sanitary reform, but it attempts quite as much as in face of the powerful interests to be encountered there is any probability of being accomplished. We accept it, therefore, in the spirit of the homely old adage which tells us that "half a loaf is better than no bread."

The first part of the Bill is directed against the very common practice of using the streams as carriers not merely for liquid but for solid refuse. This is an evil about which there can be no dispute, since the rubbish in question, even if it has no tendency to pollute the waters, interferes with their due flow, and renders floods both more frequent and more destructive. It may, perhaps, be doubted in how far the wording of Section 3 will apply to the trick of depositing cinders, tank-waste, refuse from mines, &c., not exactly in a river but close to its margin, so that the next fresh may carry it in. The language employed is that:—"Every person who puts or causes to be put or to fall, or knowingly permits to be put or to fall, or to be carried into any stream the solid refuse, &c." How these words will be construed by the Courts it would be very rash to predict. But we cannot help thinking that it would have been wiser to enact that no refuse of the kinds referred to should be laid down within twenty yards of the margin of any river.

The provisions relating to the discharge of sewage into streams are free from all unnecessary complications. The sanitary authorities are very fairly required to use "the best practical and available means to render harmless the sewage matter so falling or flowing." What such means may be is not specified, but it is left to the local boards, town councils, &c., to select from amongst the known processes whatever is best adapted to their individual case. We are also glad to find that there is no hard and fast standard laid down as to what may and what may not be discharged into any river. We have so often insisted on the futility of any arbitrary standard as applied to the polluting influents, that we must be pardoned for rejoicing over Mr. Sclater-Booth's measure as a triumph of common sense over official pedantry.

For the liquid refuse of manufacturing establishments the provisions are similar. The perplexing distinctions drawn in the Bill, as introduced last year between nuisance of old and of comparatively recent standing, no longer find a place. No poisonous ingredient likely to occur among manufacturing or mining refuse, such as arsenic, chrome, lead, &c., is made the subject of any especial prohibition, which may be regarded as great, if not too great, leniency. But the local authorities if receiving dangerous or poisonous materials into their sewers are to be empowered to require compensation for the additional outlay required in their purification. We cannot see any other possible solution of the difficulty. The law cannot fairly require every dyer, fuller, tanner, &c., to purify his own waste waters since many manufacturing establishments are built in the heart of towns, where there is no room for precipitation-tanks, filter-beds, or any of the various appliances required. We trust, therefore, that manufacturers will not oppose this clause, and that they will gradually see the way to render their liquid refuse both less plentiful and less offensive than at present. We dare not expect that in every case their success will be as signal as that of the alkali manufacturers in the condensation of their hydrochloric acid gas, and we cannot forget that even this boasted condensation, when carried to the perfection now deemed requisite, is found not a source of profit but a decided burden. It is stipulated that the local authorities shall not be bound to receive into the sewers any matter which might render the sewage or its deposit unfit for application to the land.

The two "saving clauses"—so-called, perhaps, in irony—are most objectionable. The one declares that "the powers given by this Act shall be deemed to be in addition to and not in derogation of any other powers conferred by Act of Parliament, law, or custom." This is most unfortunate. It is not fair that a quarrelsome or fanciful neighbour shall have in his reach a whole armoury of offensive weapons to use against either manufacturers or local authorities. Every one should know exactly his position with respect to the pollution of rivers. For this purpose there should be but one way of proceeding against offenders. So long as the multiplicity of remedies exists no one can tell when he is safe. The second "saving clause" is, if possible, still more amiss. By it the doings of the Metropolitan Board of Works are formally excluded from the operations of the Act. It is a common saying the greater the offender the more lenient is his treatment, and here we find it fully exemplified. Perhaps, however, had the said Board of Works been placed upon the same footing as the Town Councils of Leeds, Birmingham, or

Manchester, the representatives of the Metropolitan boroughs would have combined in opposition.

These defects apart we consider the measure useful and practicable and wish it a safe passage through the Houses.

NOTE ON PICROTOXIN.

By RICHARD APJOHN, F.C.S.,
Prælector of Chemistry Gonville and Caius College, Cambridge.

SOME time since I prepared a large quantity of picrotoxin from the seeds of the *Cocculus indicus* with a view of studying more closely the properties of this remarkable substance. After making a number of experiments on this body I have no hesitation in saying that the determination of its melting-point furnishes an easy and certain criterion of its identity.

The method I have employed for determining its melting-point claims no novelty. About half a milligrm. of the substance was introduced into a capillary tube sealed at one end. The tube was then attached to a thermometer by means of a few turns of fine platinum wire, and the whole was gradually heated in a beaker of oil of vitriol. In four experiments the pricrotoxin was observed to melt at 192° C. A specimen of picrotoxin which I obtained from Messrs. Hopkin and Williams exhibited exactly the same melting-point.

"As far as I know, the melting-point of picrotoxin has never been used as a character for its detection, and in "Watts's Dictionary of Chemistry" (vol. iv., page 643), it is asserted that picrotoxin decomposes without fusion when strongly heated. In order to test the truth of this latter statement about a grain of picrotoxin was introduced into a test-tube, and heated in an oil of vitriol bath to a temperature of 192° C., when it melted to an amber liquid. The contents of the tube when cold were dissolved in warm water, and set aside to cool. The well known stellate tufts of prismatic crystals soon appeared, and these crystals, when dried, were found to possess the normal melting-point (192° C.) of picrotoxin. From these experiments it is, I think, sufficiently demonstrated that picrotoxin has a definite melting-point, and that it does not undergo decomposition at the heat at which it melts.

I may also state that crystals of picrotoxin deposited from an aqueous solution contain no water of crystallisation, for having heated them to a temperature slightly below their fusing-point I found that they had lost no weight.

PROCEEDINGS OF SOCIETIES.

PHYSICAL SOCIETY.

June 24th, 1876.

Professor G. C. FOSTER, F.R.S., President, in the Chair.

THE following candidates were elected members of the Society:—Prof. James Dewar, M.A., F.R.S.E., and the Hon. F. A. Rollo Russell.

Prof. GUTHRIE showed the action of Prof. Mach's apparatus for exhibiting to an audience the effect of lenses on a beam of light passed through them. It consists of a long rectangular box with glass sides, in which are several movable lenses. A parallel beam of light falls on a grating at one end of this box, and is thus split up into a number of small beams, which are rendered visible by filling the box with smoke. After passing through the first lens the rays fall on a movable white rod, which may be placed to indicate the focus. The light then falls on another lens partly covered with red and partly with blue glass, in order to more precisely exhibit the paths of the rays.

Baron WRANGELL exhibited the apparatus employed by Petrochovsky in his magnetic experiments. These experiments had reference to (1) normal magnetisation; (2) the measurement of the distance of the poles of a magnet from its ends; and (3) a thermo-electric apparatus. The determinations were very much simplified by employing a unipolar magnetic needle formed by bending a small bar magnet at right angles at about a quarter of its length from one end. The needle is then suspended by a fibre attached to the end of the short arm, and the longer arm is maintained horizontal by a brass counterpoise weight. It will be evident that as one pole is in the axis of rotation it cannot have any effect on the motion of the needle. By turning up each end in this manner the moment of the magnet may be ascertained without knowing the exact positions of the poles. If a magnetic needle be so placed that a bar magnet parallel to it has no effect in deflecting it from the meridian, and the bar be then struck with a brass hammer, the state of equilibrium will be disturbed, as is shown by the motion of the needle. This, however, is not the case with a piece of soft iron round which an electric current is passing. The apparatus employed in the experiments on "normal magnetisation" consisted of an arrangement for passing a current round rods of soft iron of varying lengths, so constructed that any number of the surrounding coils can be removed in the manner of an ordinary rheostat. After the current has been passed round the bar it is moved until its residual magnetism has no effect in deflecting a delicate unipolar needle from the meridian. The current is then passed round it, and the coils are adjusted until the magnetised bar has still no effect on the needle. The effect of the coils themselves is eliminated by means of a subsidiary coil. When the current is thus adjusted, the bar is said to be "normally" magnetised, and M. Petrochovsky has ascertained that this condition is satisfied when the length of the coil is 0·8 times that of the bar, and this is independent of the strength of current. This, then, is the only case in which the position of the poles is the same as when the bar is charged with residual magnetism. For the determination of the positions of the poles of a bar magnet a somewhat complicated apparatus was employed. A large unipolar magnet, about 8 inches in length, provided with a bifilar suspension, was enclosed in a glass box. A fine silver wire was stretched parallel to the axis of the needle between two projections on it, and it also carried a fine index at the horizontal end. The wire is focussed in a telescope which can be made to travel along rails parallel to the magnet, and the index at the end can be observed by another telescope. A small magnet at right angles to the large magnet can be moved with the first telescope, and the point at which its effect in deflecting the unipolar is the greatest is ascertained by varying its position parallel to itself along a graduated scale, and then observing the space through which a subsidiary magnet must be moved in order to restore the unipolar to its initial position, as observed in the second telescope. When this point is reached it must be exactly opposite the pole of the large magnet. It was thus found that the poles are at a distance of one-tenth of the length of the magnet from its ends. To determine the position of the poles of a horseshoe magnet a delicate magnetic needle is placed below a fine wire in the meridian, and a horseshoe magnet is brought so that its two ends are immediately below the wire and near the needle. In the case of an electro-magnet the point at which its effect is greatest is found to vary when the coils are moved towards the ends, and is nearest to the ends when the coils project slightly beyond them. The third series of researches referred to was on the influence of an electric current on the thermo-electric action of soft iron. A number of strips of iron are connected by means of copper studs, and when currents are passed round the alternate strips it is found that the system acts as an ordinary thermo-pile. This question is,

however, still under investigation. In reply to a question of the President, BARON WRANGELL stated that the effect of increasing the number of coils in the horseshoe magnet on the position of the poles is also still under investigation.

Prof. BARRETT then made a brief communication on the magnetisation of cobalt and nickel. He has recently made some experiments on these metals with a view to ascertain whether they undergo any elongation or contraction similar to that experienced by iron during magnetisation. From his first experiments he concluded that cobalt elongates slightly, but that there is no effect on nickel, but this latter result may have been due to the fact that the metal was not absolutely pure. He has, however, obtained through Mr. Gore a fine bar of pure nickel about two feet in length, and now finds that it contracts, and that the amount of this contraction is about the same as the expansion of a like iron bar when similarly treated.

Prof. GUTHRIE then described some experiments on the freezing of aqueous solutions of colloid substances, which he has been studying in connection with his recent investigations on Cryohydrates, &c. If a solution of sugar be gradually cooled the temperature at which ice separates out is always below 0° C., and the extent below increases with the amount of sugar in solution. But he finds that in a solution of gum, having exactly the same chemical formula, the ice always separates at 0° C. whatever be the amount of gum present. Thus, while every crystalline substance forms a freezing-mixture when mixed with ice or snow, colloids are incapable of doing so. The gum and the water do not recognise each other, and similar results were obtained in the case of gelatin and albumen. These facts are strictly in accordance with the results of Prof. Graham's classical researches. It almost follows that when heated similar effects are observed, and Prof. Guthrie has found that solutions of gum in varying proportions alway boil at 100° C.

Mr. W. CHANDLER ROBERTS said that this important discovery was one that his late distinguished master would have welcomed, and he expressed a hope that Dr. Guthrie would continue his experiments with the series of colloids actually prepared by Graham.

Prof. GUTHRIE then showed the experiment by which Dr. Kerr has recently proved that glass, resin, and certain other substances exhibit a depolarising effect when under the influence of a powerful electrical tension. With the help of Mr. Lodge, Dr. Guthrie has succeeded in repeating these exceedingly delicate observations, but the effect is very slight, and ill suited for the lecture-room. A beam of polarised light traverses a thick plate of glass in which two holes have been drilled, nearly meeting in the centre, and two wires are fixed in these, and connected with the terminals of a powerful coil. The light after passing through the analyser falls on the screen. If now the analyser be so turned that the illumination is least before the current is turned on, the brightness of the field will be seen to increase as soon as the circuit is closed, and this brightness will gradually increase up to a certain limit. The effect is greatest when the light is polarised at an angle of 45° to the line joining the terminals.

The PRESIDENT then adjourned the meetings of the Society until November.

NEWCASTLE-UPON-TYNE CHEMICAL SOCIETY.

General Meeting, March 23rd, 1876.

JOHN PATTINSON, President, in the Chair.

(Continued from p. 258.)

Mr. R. C. CLAPHAM read the following paper:—"*On a New Decomposing Furnace Patented by Messrs. Jones and Walsh.*" In the first place I must apologise to the members for bringing before them a paper which would have been better placed in the hands of those more conversant with the new decomposing furnace, but my excuse must be that it was those very gentlemen who could have done it so well who first pressed the matter on my attention.

The best methods of decomposing salt with sulphuric acid have long attracted the attention of manufacturers, for it is admitted on all sides that those adoped hitherto in practice have been unsatisfactory, leading to expenses from partial stoppage of the work, breakage of pans, and loss of sulphuric acid.

When the present system of making soda was commenced on the Tyne in 1820 (at that time called the French system), the chemical trade was very limited, and small lead pans lined with brick work were used in decomposing salt. A charge of 2 cwts. of salt was taken, the sulphuric acid was slowly poured upon it from a carboy, through a hole in the top of the furnace, and it took three hours to complete the operation. But as these lead pans were so liable to be injured, a fire-brick furnace was substituted in 1828, which was looked upon then as an improvement and was well known locally as the "Dandy" furnace. At that time no attempt was made at the condensation of the hydrochloric acid fumes, and they passed directly into the atmosphere. A great improvement upon the above was introduced in 1840, by the late Mr. John Lee, who applied a metal pan about the same size as we now use, and its adoption by the trade has led, amongst other advantages, to a large saving in sulphuric acid. This pan has, however, been always liable to frequent breakage from negligence of workmen and other causes, and to get over this difficulty various substitutes have at times been tried. In 1860 I had some fire-clay pans made at the Scotswood Brick Works, which were used at the Walker Alkali Works. They were found to work pretty well, but were given up from the difficulty of getting them properly heated.

If we allow that the life of an ordinary decomposing pan is long enough to turn out 2000 tons of salt (in a few cases it may be more, but many of those present will know that in some cases 1000 tons is a fair quantity), I calculate that on the Tyne alone not less than £6000 per annum is spent in renewal of decomposing pans; and if we take into account the loss of time caused by the breakages, the extra labour required, and the waste of acid, the money loss under these heads will be very considerable. In the face of these facts there would then appear to be ample room for improvement. Messrs. William Jones and John Walsh, of Middlesbro', have contrived and erected a new class of decomposing furnace, which completes the whole charge of salt in one furnace. This furnace has now been at work several months, and from an examination of the plates forming the dish of a furnace which was laid off a few days ago, I found the plates to be as fresh and good as when erected.

The furnace, which is now in actual work, and from which regular results have been obtained, consists of a metal dish divided into six segments, all tightly fixed together. The metal is 2½ inches thick, and the whole rests on solid brick work. Its inside diameter is 15 feet, and the charge of salt is about 12 tons each twenty-four hours, so that a furnace of this capacity (allowance being made for draughts and local matters) will turn out about 80 tons of sulphate in six days. The batch is kept in constant motion by means of two metal arms, worked from a centre shaft, to which are fixed paddles and rakes, and the whole mass is much more completely mixed than in a hand-worked furnace, and the sulphate produced is of a fine and uniform character. Mr. Walsh, who is present, has kindly undertaken to explain the furnace more fully afterwards, from the working model on the table and from the plans exhibited. The motion given to the crown wheel is got from a donkey engine, and an engine with a 6-inch cylinder is found to be sufficient to work the furnace. At present the batch is both charged into the furnace and discharged by hand, but Mr. Goodman expects to perfect a plan to do this by machinery.

The advantages to be derived from this new furnace may be described as a more regular daily plan of working;

freedom from sudden stoppages by the breakage of the present pans; a direct saving in wages, as only one workman is required on each shift for charging and working the furnace; a saving of fuel, as the heat required is less than in the old furnace, and 3 cwts. of coke per ton of sulphates is used in the place of 9 cwts. of coals (=5½ cwts. coke) by the old furnace; a saving also of sulphuric acid calculated by Mr. Walsh to be equal to 2 per cent. Then again, owing to the complete mixing and better working of the batch by machinery, a great inconvenience felt by the public living in the neighbourhood of chemical works, by the batches being sometimes drawn by the workmen in a partly finished state, and containing free hydrochloric acid, is entirely avoided. The fumes are emitted in a gradual and uniform manner throughout the working of the batch, and the condensation is, therefore, more perfect; and as the whole of the gas is passed through one coke tower, it is condensed into hydrochloric acid of 26° to 28° T.

It therefore appears that both in an economical and sanitary point of view, this furnace is an improvement on its predecessors. In the description I have given I have purposely confined myself to a furnace in actual daily work, and from which known results have been obtained; but it is not unreasonable to expect that experience may show that a much larger weekly turn out may be possible. There are several members present who are interested in perfecting the successful working of this furnace, amongst whom I may mention my friend, Mr. Jones, one of the patentees, Mr. Walsh, and Mr. Goodman; and I shall feel greatly indebted to them if they will give the members the benefit of their experience, and fill up the blanks which I may unintentionally have left.

Mr. Jones said he did not know that there was very much which he could add to what Mr. Clapham had already said, but he might perhaps give them a short account of how they came to adopt this furnace. He might say they were absolutely driven to it by the misconduct of that very low class of workmen, the decomposing men. They had their troubles at Middlesbrough, as well as we on the Tyne had ours; and with the men constantly getting drunk and coming in and breaking the pots, it became at last a serious question whether they could not dispense with them altogether; and he made up his mind that they would endeavour to do so, even if it cost them more to do the work by mechanical means than by manual labour. That was their motive in trying this plan. Now, they found at first that continuing a few of these men to work the furnace, they had very great difficulty in getting it to work at all. By some mysterious means which they had not the means of ascertaining, the furnace perpetually went wrong at night: a cog broke, or the crown wheel gave way, or something or other went wrong; and they did not get to the end of that trouble until they had discharged every decomposing man from the place and got common labourers to do the work. Since then they had got on very much better with the labour department. He might say that now the labour was done by one man—a strong, serviceable fellow who had been a cab driver, and he drove the machine by day, and his mate by night; so that by means of one man each shift they were now doing the work which formerly required three men—that was to say, they had a decomposing man at the pot, and of course they had a man at the roaster, and a man wheeling to the pot. Now, their one man does the whole of this work with the present machine. He wheels his own charges, he charges the machine, he minds it during the operation, and he discharges it; so that they would see that in those points there was a very considerable saving of labour; and the fact was that at the present time they were simply paying this man—or rather these two men—who work the furnace at the rate of 1d. per cwt.; for that they did the whole of this work, and were earning nearly £3 a week each, so that they were liberally paid—too liberally paid. There was no doubt that by quickening the process a little they could do better. They had not yet got quite all the satisfactory results they wished for, but by shortening the times of the charges, and getting a larger output, they would work the furnace considerably cheaper than they were doing. Their Mr. Walsh said he would not be satisfied until he got it done for ½d. a cwt., or 10d. a ton. He had not got it to that yet, but he had accomplished so much that he (Mr. Jones) did not doubt he would do it. As to the time of working the charges, they were at present working the furnace under a little want of draught, and therefore it had not yet quite fulfilled Mr. Walsh's expectations as to the amount of output; it was doing very little more than a smaller furnace which they had at work previously, and which had a better draught. But this was a mere mechanical matter, which could be put right in a few days. Then, it would be a great point to save time and save fuel by getting the charges put in and withdrawn by mechanical means, and a considerable saving could be effected in that way. Gentlemen would easily understand that a man could not throw five tons of stuff into anything with a shovel in a very short time; it took fully an hour—with a very good man indeed—to throw in five tons with a shovel; so that that hour is practically lost in charging a machine; and it took a still larger time to draw that charge out by hand. These were the two points which Mr. Goodman thought he would be able to improve upon very materially by means of the contrivance he showed upon that plan, and he (Mr. Jones) did not doubt it would be so. When these were added to the existing furnace, he was strongly of opinion that it would turn out fully what Mr. Clapham had stated in his paper that night, and perhaps more. He was not aware there was any other point which it was necessary to mention except this—that in Middlesbrough, as many were here, they were formerly always in hot water with regard to nuisance. This was always a very delicate point with them at Middlesbrough; and being isolated chemical works, they were more easily "spotted" than we were here on the Tyne; they could not throw it upon a neighbour as we could here. It was always known to be the chemical works; whenever there was a stink in the town, either from brickworks or anything else, the unfortunate chemical works had always to bear the blame. Well, now, fortunately with this furnace they had no trouble whatever in that respect. Many of the gentlemen present had been at the works during the time the furnace was working and while the charges were being withdrawn and laid on the floor, and he thought they would bear him out in saying there was no nuisance from escaping gas worth speaking about. Then, as regards the condensing, he thought this was a satisfactory point, viz., the whole of the hydrochloric fumes as well as the products of combustion pass from the furnace into the condensers. They had an arrangement for cooling the gases before they entered the condensers. Gentlemen had been afraid the heat would break the flags, but they need not have been nervous on that point; the heat was not so great as to damage any of the flags, and they cooled the gas a little before it entered the condenser by means of a jet of water. But the result of this arrangement was, they had the whole of their hydrochloric acid at a suitable strength. It runs from the condenser usually at about 26° T., and of course they got rid of the two towers. They had no roaster tower, but all the gas went through one, and was obtained from the condenser as muriatic acid at a strength of about 26° warm.

Mr. Mond asked if Mr. Jones would state what quantity of muriatic acid 26° he obtained from a cwt. of salt. It looked to him to be a wonderful result for one tower getting heated acids to complete the condensing. He knew they had not been able to do so in Lancashire, where they had worked hard to improve their furnaces.

Dr. Lunge thought it only fair to state as an unbiassed witness that Mr. Mond had assured him that the condensation at Messrs Jones and Co.'s works was excellent; and when he (Dr. Lunge) was there, a gentlemen who

was there along with him assisted Messrs Jones's chemist in taking a chimney test; he was present at the test, and they then found the escape only to be 0·1 of a grain per cubic foot—which of course was an excellent result. He thought the explanation of the difference between the results of Messrs. Jones's furnace and that used at the Lancashire works—those, for instance, of Messrs. Hutchinson—where both the oven and roaster gases are going along into the condensers mixed with fire gases was this—that, in the first case, the evolution of the gases was over quickly, while here it was given off very gradually, and of course the condensation was comparatively easy in that respect; and, secondly, the temperature of the furnace was evidently far below that of an ordinary open fire-grate. He might say that the cooling arrangement at Messrs. Jones's works, as Mr. Jones himself had mentioned, was only of a temporary nature, and might, in his opinion, be improved greatly. He went to the works with this question in his mind—how the condensation of the acid might be effected; whether the condensation of the acid could be effected completely, and a strong acid? and he came away entirely satisfied on that point. As he was on his legs he would like to ask another question—that was with regard to the output. The output of the furnace was stated at 80 tons. When he was at Middlesbrough the charges were not so much as that; he thought it would be only about 50 or 60 tons they would be getting there. Of course the pan was not so large as the pan which Mr. Goodman had designed; and it was also perfectly clear that the mechanical arrangement for charging and discharging would lessen very largely the time in which the process could be completed, and possibly enable the three charges to be made into four—the charge to be completed in six hours instead of eight, which of course would very largely increase the production. On this point it might perhaps be interesting to many members to receive some more specific information from the patentees.

Mr. Glover asked if Mr. Jones would also state the superficial area and cubic capacity of his condenser?

Mr. Jones said, Mr. Walsh told him that their condenser was 6 feet square inside and 40 feet high, and the meeting could easily work that out. In reply to Mr. Mond, he could not say exactly the proportion of hydrochloric acid obtained per cwt. or ton of salt—they never worked exactly to that scientific accuracy. They had, however, got a good name for condensing, as Dr. Lunge had said, and Mr. Todd (the inspector) thought it very good. He had before him a few of the tests, from the condenser itself, taken by Mr. Todd in the chimney:—Feb. 4, it was 0·1; Feb. 7, 0·09; Feb. 10, 0·08; Feb. 14, 0·11, &c., &c. None of them exceeds 0·2.

Mr. Glover—I infer that your draught is from the top of the condenser into the chimney.

Mr. Jones—Yes; we have a pipe from the top of the condenser down to a flue leading to the chimney. Then with regard to the wash tower, to which Dr. Lunge had referred, there must, of course, be some small amount of gas condensed by the spray there, but he had tested it himself personally several times, and had never found it stand higher than 1°, so that it did not amount to much, and water of that strength could easily be pumped up if necessary, and used in the condenser. They did not do that at Middlesbrough; they had no arrangement for it. The very gradual way in which the gas was evolved was, as Dr. Lunge had stated, in favour of a perfect condensation. They did not get it off in a great rush, as they used to do in charging a decomposing pot. The condenser used to be overpowered, and there was a back draught into the faces of the men. Now, the salt was gradually charged into the furnace, and came gradually into contact with the acid. Another little matter that occurred to him was, the question of the wear of the iron work of the furnace. Whilst the arms of the agitator were of wrought-iron there was a tendency in them to bend considerably, so that they had to stop the furnace for the purpose of renewing these arms. In the furnace now at work they had no wrought-iron work, the arms and scrapers were made of metal. There was on the table a sample of a scraper, which had been working in the present furnace for nearly three weeks. That was the original form and size of it, and, as gentlemen would see, it had worn down only three-quarters of an inch during that time. That was the whole of the wear of the iron work during that time; there had been no visible or perceptible wear in the pan itself. They had had the pan, which was erected last November, very carefully examined (it had been working very steadily up to now), and there was no appreciable wear of the pan. The rest was closed-in brick work, and the heat, not excessive, passing over the surface of the stuff did not seem to affect the metal work of the pan at all.

(To be continued.)

CORRESPONDENCE.

THE CHEMICAL SOCIETY.

To the Editor of the Chemical News.

Sir,—Of all the aggrieved who have lately occupied so much of your valuable space not one has clearly stated the reason of the systematic and indiscriminate black-balling resorted to by some of the members. A kind of undefined vague feeling seems to prevail amongst them that by a proceeding of this kind the status of the Society will be raised: the motive is an excellent one, but the results of the movement have been anything but satisfactory. Mr. "Twig" writes to say, "We want unity and vitality," and he then proceeds to use his utmost endeavours to destroy the unity and injure the vitality of the Society. Some of them, again, compare the Chemical with the Royal Society, forgetting that the latter is a close society, and therefore differing entirely from the former. The real question is—Does the Chemical Society adequately carry out the object for which it was founded, viz., "The general advancement of Chemical Science?" No one who has watched the progress of the Society during the last six or seven years could conscientiously say that it does not. It follows, therefore, either that the grievance of the blackballers is fictitious, or that they have a design to alter the constitution of the Society.

The character of a large Society like ours depends, not so much on the qualifications possessed by individual Fellows, as what they do collectively to advance science. It is simply ridiculous to speak of the Society "in words of open contempt" because some of the Members are not "chemists by profession." In face of the fact that some of the Officers of the Society are *dilettanti* who have earned a European reputation by their labours in chemical research, the blackballers would exclude a man merely because he is a *dilettante*—because he does not practise chemistry as a profession. It is possible there may be some Fellows of the Society who abuse its privileges and make use of the letters F.C.S. to impose upon the unscientific public. These, however, are not *dilettanti* but "professional chemists," whom it would be vain to attempt to exclude by the requirement of a statement of qualifications, so much insisted on by the blackballers: as in the case of the vendors of spurious degrees or promoters of bogus companies *et hoc genus omne* they would no doubt find it an easy matter to prepare a certificate which would appear very satisfactory in this respect. For such men, however, to obtain the signature of our President, or any member of like standing, would be an impossibility.

Prof. Roscoe calls the blackballing meaningless. It is to be feared, however, that it is not so in all cases, but that self is really at the bottom of the movement; how otherwise should we have some of your correspondents complaining that it is not an honour to belong to the

Chemical Society, that the letters F.C.S. are not "something of definite value," which in plain English means that the mere fact of being a Fellow of the Society does not materially help them in their professional career. It is quite true F.C.S. put after a name does not signify that the possessor is a good chemist, and, what is more, it was never intended it should do so.

A word on a personal matter. One of your correspondents say the writer of the present letter is himself a "younger brother." It is true. I have scarcely attained my chemical majority; for although I had some knowledge of the science at a comparatively early period, it is but little more than nineteen years ago since I began to study it systematically under Dr. Hofmann, and it is not yet quite sixteen years since my first paper was read before the Chemical Society. I suppose your correspondent thinks all young men ought to join the pseudo-reforming clique. Blackballing, like measles, hooping-cough, and other infantile diseases, is no doubt "catching," but it is sincerely to be hoped that it will not become epidemic, or at all events that some of the younger members may escape. That the blackballers at present are but few in number, notwithstanding some of them have said to the contrary, is a fact which admits of easy verification. Any. one who was present at the meeting on the 15th, and took the trouble to count the voters and divide the total by four, would have found considerable difficulty in adjusting the small quotient so as to include "numerous followers and able leaders." Some of the blackballers seem to think the Fellows are ignorant of the ordinary rules of arithmetic.—I am, &c.,

Charles E. Groves.

PS.—Allow me more particularly to draw the attention of your readers to the circumstance, already alluded to by Professor Roscoe, that not one of the partisans of blackballing has had the courage to append his name to his letter.

ORGANISATION AMONG CHEMISTS.

To the Editor of the Chemical News.

Sir,—Feeling considerable interest in the scheme for an organisation amongst chemists, and noticing that most of your correspondents appear to be gentlemen who have already obtained a fair position as chemists, I venture to address a few words to you from a point of view that has not, as far as I have seen, been taken up in any of the numerous letters upon the subject, namely, the great advantage that would accrue to those who are desirous of making chemistry their profession if the proposals of an organisation were fairly and fully carried out.

At present there are no schools of chemistry the course of instruction in which qualifies a student for the profession, neither are there any examining bodies to which he can apply to show his practical capability of undertaking any kind of chemical work.

Those students who have obtained their knowledge by private study or by attending the smaller science schools find their path beset with difficulties. It is useless for them to refer to their teachers for recommendations, for these would carry no weight, and there being no society from which they can obtain qualifications their efforts to obtain employment would probably be in vain. Of course those students who have been assistants to or studied under well-known Chemists will not have these difficulties, but then these are not always the best adapted to the profession. There are men who have never had these advantages who would be likely to make great progress if they could obtain a fair beginning.

Then, again, an organised society with power to confer distinct qualifications to its members would raise Chemistry to the level of the other professions, a position which it certainly does not at present occupy. The outside world has scarcely the shadow of an idea what is implied by the term "chemist," and even those positively engaged in the application of chemistry do not know with much greater certainty the range and limits of their profession. Of course they all have some kind of an idea, but these differ considerably.

There is one point, however, which, for my own part—and in which all persons who have spoken upon the subject agree with me—I must strongly object to in the proposed regulations, and that is excluding everyone who is under twenty-six years of age. With any of the other professions the full qualifications can be obtained by the age of twenty-one, and it is unreasonable to make it more difficult to enter the chemical than the other professions.

However, that an organisation of some kind be formed is of more importance than it seems on the surface. It is of small import whether this be connected with the Chemical Society, the Chemical Department at South Kensington, or whether it exists upon a distinct foundation. Trusting that the desired end will be obtained by those gentlemen who are working to place chemistry upon a fair basis as a profession.—I am, &c.,

F. Sexton, Assistant D.C.

Dulwich College, Dulwich, S.E.

THE RELATIONS BETWEEN THE CHEMICAL SOCIETY AND THE ORGANISATION MOVEMENT.

To the Editor of the Chemical News.

Sir,—The Council of the Chemical Society having now definitely decided on the course of action which they are prepared to recommend to the Society (subject to the acceptance thereof by the promoters of the organisation movement), the Members of the Council are now free to do what they were hitherto debarred from doing, viz., to discuss publicly the various aspects of the question, and to promulgate their own views on the subject. I would therefore beg space for the insertion of the following remarks on the general aspect of the question.

I may as well premise that since the publication of my first communication on the subject (Chemical News, vol. xxxiii., p. 40) my own views have undergone more than one change. At first, I was disposed to think that the objects of the desired association or guild of chemical practitioners were entirely different from the ground hitherto covered by the Chemical Society; that the policy of that Society hitherto adopted rendered it unsuitable as an origin of the desired association; and that the Society and the Professional Association were entirely separate in their nature, and incapable of fusion together without injury to both. I subsequently was led to think that there were numerous difficulties in the way of establishing such a separate association: and that although a scheme for organisation through the Chemical Society would not by any means do all that seemed necessary and desirable to be done, it would nevertheless enable a distinction to be made between competent and incompetent men, and that it might be preferable to sacrifice a portion of the ends to be aimed at in order to facilitate the attainment of some of them. Finally, an attentive study of the nature of the steps which appear to be possible for the Society to take under the existing Charter has induced me entirely to revert to my former opinions. So few of the results aimed at by organisation appear to be likely to be effectively attained if this be attempted to be carried out through the Society that I am reluctantly compelled to believe that in proposing to do anything of the kind the Society will only weaken itself by uselessly stirring up dissention amongst its members.

Collating the opinions of a large number of chemists of high repute from all parts of the United Kingdom, who have been privately communicated with by one or other of the gentlemen who, with myself, have endeavoured to bring this subject prominently before the chemical public, I conclude that what is generally desired is to put the

occupation of a consulting and analytical chemist on a par with other recognised professions, *i.e.*, to give it a legal status; to do as is done in the clerical, legal, and medical professions, viz., to prevent as far as possible persons who are not properly qualified to do certain work from being able to impose on the public generally, by obtaining (or at least endeavouring to obtain) suitable enactments preventing such persons from being able to give certificates admissible as evidence, and to *enforce* payment for their services: to establish by the general consent of those practising the profession a Board controlling professional malpractices, so as to take away the stigma which the existence of "high" and "low" analysts and the like have brought on chemists generally, and to establish an association which shall have the power to take such steps, as circumstances may from time to time render desirable, for the public welfare and the efficient discharge of the duties of the sanitary officer, the manufacturer, the analyst, and all the other citizens whose occupation necessitates a thorough knowledge of chemistry in some form or other.

It has been objected that this is a "Trades' Union." So it is, in the same sense that the legal and medical organisations of this country, the Established Church, and many other institutions of repute are "Trades' Unions." An association of professional men (*i.e.*, brain-workers) for the mutual advantage of the community at large, and of themselves, does in truth bear considerable resemblance in many respects to an organisation for the same purposes amongst handicrafts'-men: in fact, the chief distinction lies in the nature of the work done, mental *versus* bodily. These correlations and differences are embodied in the very term "Professional Association."

The establishment of a Professional Association of this kind, then, being the object to be aimed at, the question arises, What are the steps that should be taken in order to effect this object in the best way? I only propose here to deal generally with the broad question, "Should the Chemical Society, if practicable, be made the starting-point for such an Association." As for the details, either of the plans proposed by the Council of the Society, or such other scheme as the Fellows generally may think fit to propound, they may be safely left to after-consideration when the subject comes (if it should come) before a general meeting of the Fellows.

The principal arguments on behalf of and against this broad question I take to be as follow:—

Firstly for the Proposition.—It may be argued (1) that unity in the chemical world is a desideratum, and therefore *a priori* the Society should be the centre of the movement. The truth of this is incontestable, provided the nature of the Society permits of its being the centre of the movement, which is the point at issue.

(2.) Many persons think that the Society would be very likely to suffer in numbers, funds, and influence were an Association to be formed entirely disconnected from it, whilst the contrary would be the case were the Society intimately connected with the movement. This is a matter of probabilities and opinion. Many persons think, on the other hand, that no injury to the Society would accrue were the two entirely disconnected. Whilst many doubt if the Society, as a society of a *scientific* character, would be really permanently benefitted by being connected with a Professional Association.

(3.) Were an entirely separate "Institute" started there is at least a possibility of its opponents and rejected candidates endeavouring to form a rival association; and as the general public would not for a long time distinguish between the association of competent men and that of inferior ones, such a proceeding would to some extent hamper the movement: whereas, if the movement have its origin in the Society, successful rivalry on the part of an opposition would be, it is alleged, well nigh out of the question. It cannot be denied that there would be a great advantage if rival associations of imperfectly qualified men could be practically rendered impossible of formation; but as to whether the kind of development of the Chemical Society which alone seems practicable under its Charter would be more or less efficacious in this direction than an independent association there is clearly room for much difference of opinion. Many with whom I am acquainted think that the imperfect character that any scheme working through the Society must necessarily possess would rather render opposition schemes more probable of initiation than would be the case were a more thorough independent association formed.

(4.) As a matter of policy, various influential men are supposed to be willing to forward a plan for organisation which might add to the power and influence of the Society, and more particularly of its Council, whilst they would either actively oppose, or at least hold aloof, from a movement not springing therefrom. Unfortunately, there appears to be considerable truth in this argument. Still, in the event of the majority of those interested in the question deciding that an independent association is on the whole preferable, even the active opposition of a few, however highly placed, could only delay and retard the development and progress of such a scheme, and would not suffice to frustrate it.

Secondly, against the Proposition.—It is alleged that (1), whether rightly or wrongly, a by no means inconsiderable number of Fellows of the Chemical Society are dissatisfied with its government and policy generally; the constitution and mode of election of its Council does not meet with universal approval, and there is, in consequence, a possibility of internal storms arising at no distant period. Under these circumstances, to connect itself with a movement of a most reforming character is a dangerous action on the part of the Society, its stability being thereby somewhat imperilled; whilst for the movement to ally itself with an institution the members of which are not in harmony is unwise, as it would seriously handicap the movement.

(2.) Under the Charter of the Chemical Society Fellows voting at the election of Officers and Council must be personally present at the annual election; proxy-voting and voting by letter are not possible. In the election of a Board of Management of a Professional Association it is manifest that every qualified man ought to have a right to vote whether he be bodily present or not.

(3.) The Charter of the Society, although enabling (in the opinion of eminent lawyers) more than one kind of Fellow to exist, would not admit of any other title being applied to the body of professionally competent men selected from the general body; so that these selected Fellows must be distinguished as "Professional Fellows" or "Practising Fellows," or in some analogous way. Now, firstly, it seems not at all unlikely that the general body of Fellows would refuse their assent to the establishment of such a selected class consisting of only a fraction of the total number of Fellows, on the ground that the others would thus be degraded to a lower level, and that this was not precisely the object they had in view in joining the Society. Secondly, it is open to question whether such a title as "Practising Fellow" would be sufficient to distinguish thoroughly the competent selected men from less thoroughly qualified individuals who might happen to possess the F.C.S.; in short, whether the chief practical object in view—viz., distinguishing sharply good chemists from indifferent ones—would be adequately effected in this way.

4.) Certain clauses in the Charter of the Society render it impossible that this Society should be developed into a Professional Association of the desired kind without altogether destroying its character as a Scientific Society, if indeed such development be at all possible. The Council of the Society (subject to the direction and control of the general meetings of Fellows at which every Fellow has a right to be present and vote) is the only committee or body which can "direct and manage the concerns" of the Society. Any sub-committee or Board appointed by the Fellows (or by the Council subject to their consent) must either be directly subordinate to the Council or to

the general body of Fellows, or both. New regulations and bye-laws can only be made and established at General Meetings of the entire body of Fellows, and are only valid provided they are not inconsistent with the Charter (which, like most documents of the kind, is in various places susceptible of more than one construction). Consequently, supposing that a Committee or Board were appointed, either by the whole body of Fellows or by the Council subject to their consent, for the purpose of taking charge of the matters which would form the business of a Professional Association, the decisions of the Board could only be made *subject to the approval of the Council, or of the whole body of Fellows, or both.* The power and authority which such a Board *must* possess if it is to be at all efficacious as the executive of a Professional Association would not be possessed by the Board appointed through the Chemical Society. Such a Board would have no power over the funds subscribed by professional men for professional purposes. It could only recommend to the Council that the funds should be employed in such and such ways, and could not enforce their employment in these ways should the Council not see fit to act on their suggestions; and it could not prevent the Council (or at any rate a general meeting of Fellows) from appropriating these funds to wholly different purposes should a majority decide on abolishing or modifying the then existent bye-laws relative to these funds. Such a Board could not make regulations which *must* be obeyed by every professional man belonging to the Association. It could only recommend to the Council certain new bye-laws, and the Council could not ratify these without calling together a general meeting of the whole body of Fellows, so that *the regulations of the Association would finally be subject to the approval of a body, the majority of which could not belong to the Association.* Such a Board, indeed, could never have any permanent character, as its very existence would be entirely dependent on the assumption that at every future annual meeting the general body of Fellows were pleased to approve of its action, and to re-appoint it for such a period as some special bye-law should state; and even the bye-laws to which the Board owed its existence might be revoked and altered at a future general meeting, and the whole class of Practising Fellows abolished.

One natural result which would spring from the establishment of such a Board would be that the Professional Fellows of the Chemical Society would combine together so as to alter the mode of electing the Council, and so to influence the elections as always would ensure the decisions of the Board being of necessity ratified so far as the Council could ratify them; in other words, the Council would become not the managing committee of a purely scientific society, but that of a professional association pure and simple. Alterations in bye-laws other than those relating to the constitution of the Council would be gradually introduced; intestine squabbles in the Society would be rendered imminent; and, finally, neither the Society nor the Association would be an institution of stability. From the point of view of the interests of the Society, it seems extremely undesirable that such a course should be adopted as will inevitably lead to disputes and revolutionary measures. The tendency towards the latter is already strongly marked, but is as yet only taking the direction of useful reforms. The importation into the question of other considerations, however, might tend to pervert reform into total anarchy.

The consideration of the foregoing arguments, Sir, has finally induced me to conclude that whilst it is possible for the Chemical Society, under its present charter, to make distinctions between those of its Fellows who are well qualified professional men and those who are not, it is impossible to carry out through the medium of the Society a scheme for the thorough organisation of the chemical profession, whilst the attempt at drawing such distinctions is a dangerous experiment for the Society to make, inasmuch as it is by no means certain that such a plan would be assented to by the Fellows generally, and discord and want of harmony would certainly be engendered and promoted. There still, however, remains the possibility of the Society giving up its present charter and applying for a new one empowering the Society to split itself up into two sections, Professional and Scientific, each section having its own Council, the one elected by the professional members only, the other by the general body of Fellows; and each section having supreme and independent control over the funds and general business pertaining to it. To this plan, however, there are the objections that almost perfect unanimity of opinion as to the desirableness of such a course must exist amongst the Fellows, and it is not very likely that this would be the case; whilst even if every existing Fellow desired it, it is very improbable that such a new charter would be granted.

On the whole, therefore, it is now tolerably clear to me that if a Professional Association of an effective character is to be originated, it must be apart from the Chemical Society. There then arises the question, Is it preferable that this Association should be wholly independent of any existing institution, or is it feasible to develope either the Chemical Section of the Society of Arts or the Society of Public Analysts into the required organisation? Many of the objections which apply to the general proposition of development of the Chemical Society would apply in these cases also. The Society of Public Analysts, moreover, has as yet hardly attained to such dimensions and favour in the eyes of the chemical profession as to render it a specially desirable nucleus, although in the event of its being clearly shown that an entirely independent institute would not best meet the views of the majority, it is quite possible that this Society might be rendered a more effective starting point than the Chemical Society promises to be.

In view of the approaching vacation and of the great interest which this subject has excited, it seems hopeless to expect that any definite conclusions will be come to by those interested in the subject before several months have passed: and indeed, precipitation in such a matter would be very unadvisable. But after those concerned have duly reflected on the various bearings of the subject, and have fairly weighed the different pros and cons so that each one may have looked well at the matter from as many points of view as possible, it is to be hoped that a definite scheme for the organisation and consolidation of the chemical profession will be arrived at, and that those who find themselves in the minority when a final division may be called for, will yield their own convictions for the general good, and that all will co-operate together to advance and perfect that plan which meets with the approval of the majority of those qualified to give an opinion on the subject.—I am, &c.,

Charles R. Alder Wright.

Scientific Club, 7, Savile Row,
June 25, 1876.

"PRELIMINARY NOTES" OF CHEMICAL RESEARCHES.

To the Editor of the Chemical News.

Sir,—On page 324 of the *Journal of the Chemical Society* for 1874, there appears a "Preliminary note on Perbromates," by Mr. M. P. Muir, F.R.S.E., in which he states that an aqueous solution of perbromic acid may be easily obtained by the action of bromine on the hydrate of perchloric acid dissolved in water, and that this solution neutralised with potash deposits crystals of potassium perbromate. He also describes the formation of barium and copper perbromate, but in the communication there is not a single numerical quantity, reaction, or result of an analysis given. In the report of the last meeting of the Chemical Society in your journal of June 23, another preliminary note on the same subject

was communicated by the same author, in which, if the report in your journal be correct, he says that he has not been able to prepare the salts in the manner he before stated, in fact a contradiction of the results published in 1874. Now credit must be given to the author for having at once acknowledged the inefficiency of the method, but at the same time this case is typical of certain others which have occurred previously, in which statements founded on insufficient experimental data have been communicated under the form of preliminary notes, and I think it is a matter deserving of consideration as to whether notes of this kind should be published in the *Journal of the Chemical Society*. It is not as if we had only one record of chemical progress, but there are both the *Journal* of the Society and the CHEMICAL NEWS, and if I may be allowed to express an opinion I certainly think that notes of the kind alluded to should be published in the abstract of the proceedings of the society given in your journal, but not in the *Journal* of the Society itself, especially when they contain no numerical result, and may be found necessary of correction at some future date. This matter would have passed without comment had it not been that an investigation of the perbromates was being commenced in the laboratory here; but this, in deference to the preliminary note in 1874 having been given up, much valuable time is lost.—

I am, &c.,

J. M. THOMSON.

King's College, W.C.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

Improvements in the manufacture of chromates of potash and soda and their bichromates. J. White, Fleet Street, London. March 1, 1875.—No. 746. This consists in slaking lime with sulphate of potash in solution, and adding chrome ore to this mixture.

A new and useful improvement or process of smelting and refining copper ores and metallic copper. S. L. Crocker, Massachusetts, United States of America. March 2, 1875.—No. 768. This complete Specification describes a process which consists in adding zinc in small quantity in a furnace to the copper ore or ores, or to the partially refined metallic copper therein containing arsenic and antimony, whereby these impurities can be readily removed.

Improvements in the method of and apparatus for the manufacture of glucose. S. H. Johnson, Lea Bank Works, Warton Road, Stratford, Essex. March 4, 1875.—No. 810. According to this Provisional Specification grain suitably impregnated with acid is treated with steam in such a manner that the steam may permeate amongst the grain and so rapidly bring it to the temperature at which the conversion takes place.

A new or improved metallic alloy. A. M. Clark, Chancery Lane, Middlesex. (A communication from A. Le Marquand, Paris.) March 4, 1875.—No. 815. The invention relates to a new white metallic alloy or white metal, which is not liable to oxidation, composed of the following ingredients:—

Pure copper	750 parts.
Pure nickel	140 ,,
Oxide of cobalt	20 ,,
Tin	18 ,,
Pure zinc	72 ,,
	1000

Improvements in the manufacture of cast-steel ingots, and in apparatus for casting and rolling the same, parts of which are applicable to rolling iron. M. Scott, Sardinia Terrace, Glasgow, Lanark. March 5, 1875.—No. 816. This invention relates to the casting of steel ingots, and to rolling the same or wrought iron. For casting the ingots, a number of moulds are set round a central git on a wheeled platform with a spare mould for receiving overflow metal from the git. The git and moulds are divided longitudinally, the halves secured together by elastic rings driven on their taper exterior. The metal is run by a spout from the furnace into the git, whence it flows by fire-brick runner pipes to the bottoms of the moulds. A slag box hinged on a truck with means of tipping it receives the cinder from the furnace after the moulds are filled, the spout being turned aside. The air-holes in the tops of the moulds are bellied, so that the ingot has a projecting head by which it can be conveniently lifted and moved. For consolidating ingots grooved rollers are used to give local squeezing by indenting the ingots with furrows, and then plain rollers for flattening down the ridges. To avoid the inconvenience of reversing or two-storied rolls, two sets of rolls are arranged end to end, one set a little in advance of the other, and are driven in opposite directions. The ingot or bar rolled in the one set of rolls is received on a cradle and transferred to the other set of rolls. The grooved rolls and arrangement and mode of operating with the two pairs of rolls are applicable in rolling wrought-iron.

An improved system of and apparatus for extracting mercury and other volatile metals from their ores. W. E. Newton, Chancery Lane, Middlesex. (A communication from H. Berrens, Paris.) March 10, 1875.—No. 894. The object of this invention is to precipitate or condense all the mercurial vapour that the uncondensable vapours (which accompany it from the furnace) alone shall escape into the outer air, while the vapour of mercury, together with such substances as water, tar, sulphurous acid, pyroligneous acid, or other condensable vapours, shall be found precipitated in the condenser. The sulphurous acid combines with the oxygen of the water, and is precipitated in the form of sulphuric acid.

NOTES AND QUERIES.

*** Our Notes and Queries column was opened for the purpose of giving and obtaining information likely to be of use to our readers generally. We cannot undertake to let this column be the means of transmitting merely private information, or such trade notices as should legitimately come in the advertising columns.

Murcuric Iodate.—Allow me to add to the abstract of my paper on the above which is in last week's CHEMICAL NEWS the following:—Mercuric iodate dissolves in 2 molecules of KBrNaCl and NH_4Cl if the solution be boiling, and in 3 molecules in the cold. 4 molecules of KI dissolve 2 of $HgzIO_3$.—C. A. CAMERON.

TO CORRESPONDENTS.

Nuntius, Cantab, F.C.S., Chemicus, Beta, R. G., Chemist, J. B. W., and others.—Owing to the extreme length of the Correspondence on the Chemical Society it has become necessary to exclude all letters which do not bear the names and addresses of the writers.

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THE CHEMICAL NEWS.

VOLUME XXXIV.

EDITED BY WILLIAM CROOKES, F.R.S., &c.

No. 867.—JULY 7, 1876.

THE CHEMICAL SOCIETY.

We referred last week to the fact that nine years ago there existed a similar state of affairs at the Chemical Society to that now existing. So precisely parallel are the two cases that the remarks we then made in this journal respecting the Charter and Bye-Laws of the Society are, we think, equally applicable to the present case. We therefore reproduce this article in the hope that a more careful consideration of the Charter and Bye-Laws will lead to the adoption of such measures as will render the recurrence of such disputes impossible.

"On his admission, each Fellow received the regulations of the Society, together with sundry other formal documents; but we venture to say that not many looked at them a second time, and few will now be able to lay hands on a copy of the Charter and Bye-laws, to which we now propose to direct attention. When everything is going on smoothly the laws and regulations of the Society are dormant.

"It now appears that for many years the Society has been acting contrary to the Charter in electing Fellows, honorary and foreign Members, and Associates, according to the existing Bye-laws.

"By the third paragraph of the Charter of Incorporation, granted to the Society in 1848, it is declared—

"'That at all General Meetings and meetings of the Council the majority present and having a right to vote thereat respectively shall decide upon the matters propounded at such meetings.'

"Again, the concluding paragraph of the Charter declares—

"'That no resolution or bye-law shall, on any account or pretence whatsoever, be made by the said body politic and corporate in opposition to the general scope, true intent and meaning of this our Charter; and that if any such rule or bye-law shall be made, the same shall be absolutely null and void to all intents, effects, constructions, and purposes whatsoever.'

"Now, it is very evident that the Bye-law, making the election of a candidate depend upon the votes of three-fourth of the Fellows present, is in direct contravention to the "true intent and meaning" of the first-quoted paragraph of the Charter; and therefore such Bye-law is, according to the terms of the second citation from the Charter, 'absolutely null and void to all intents, effects, constructions, and purposes whatsoever.'

"But it may be argued that the third paragraph of the Charter refers only to anniversary meetings or extraordinary meetings of the Society. An attentive examination will, however, show that by the term 'general' meeting is intended that which is now commonly called an 'ordinary' meeting. The term '*ordinary* meeting' strictly means *regular* or *customary* meeting: a *general* meeting means one public or common to the whole of the Fellows. Custom has sanctioned the omission of the word 'general' as qualifying the ordinary meetings, but it is still retained in Bye-law, which speaks of an *extra*-ordinary general meeting, which, logically and grammatically, can only mean a *general meeting* held *extra*, or in addition, to the *ordinary* bi-monthly meetings.

"The term 'general meeting' occurs several times in the Charter, but nowhere do we find the terms 'ordinary' and 'anniversary' meetings. When, however, we refer to the regulations of other learned societies, no longer can there be any doubt as to the meaning of the term 'general' meeting. In the Charter of the Royal Society no mention is made of meetings of the members, ordinary, extraordinary, or general. But in the Charter of the Zoological Society the term 'general' meeting is used in a sense applicable only to ordinary meetings; and in the Bye-laws the monthly meetings of the Society are invariably spoken of as 'general meetings,' or 'ordinary general meetings.' In the Charters of the Linnæan and Geological Societies likewise the term 'general meeting' is used to express the ordinary meetings of the members, and in the Bye-laws these are invariably termed 'general' meetings; the 9th section of the rules of the latter Society, in fact, state that 'the *general* meetings to be held by the Society shall be of three kinds:—1. *Annual*; 2. *Special*; 3. *Ordinary*.' It cannot, therefore, be doubted that the term 'general' meeting in the third paragraph of the Charter of the Chemical Society means the same as the term 'ordinary' meeting does in the Bye-laws.

"No one, we imagine, will dispute that the election of Fellows is a 'matter propounded' at a meeting upon which the 'majority present' are to decide. On the contrary, the question as to whether a candidate is to be admitted to the Fellowship of the Chemical Society is a very important matter propounded to those present who have a right to vote, and the question, above all others, which should be carried by a numerical majority.

"In strict logical interpretation, therefore, those candidates who were blackballed at the recent meetings of the Society were excluded from the Fellowship in error. A numerical majority of voters were in favour of their admission, and at the present time the blackballees are as strictly entitled to the letters F.C.S. as are any of the blackballers.

"We confess we see only one course to be pursued in respect to the Bye-laws which remit the decision on such important matters as the election or removal of Fellows

to a small minority, in opposition to the wishes of the great bulk of those present. Strictly speaking, these restrictive Bye-laws never had any legal existence, and they should at once be replaced by others in conformity with the Charter.

"One half of the problem now under discussion—that of preventing voting by ballot becoming an organ for the gratification of personal pique—has solved itself in a manner which leaves nothing to be desired. The first part of the question—How to guard against the admission of unfit persons into the Society—is one in which Council and Fellows are free to act, for the Charter specially provides that they 'may alter, vary, or revoke, and may make such new and other Bye-laws as they shall think most useful and expedient for the said body politic and corporate, so that the same be not repugnant to these presents.' Thus the way is clear to a satisfactory settlement of the recent unwarrantable proceedings and the permanent prevention of their recurrence, and to the establishment of safeguards against the degradation of the Fellowship of the Chemical Society."

NOTES ON VANADIUM COMPOUNDS.

By Dr. B. W. GERLAND.

I.—Vanadic Sulphates.

1 (*a*). $Va_2O_4,3SO_3,4H_2O$. *Insoluble* Modification.

Vanadic sulphate is readily obtained in solution by the action of dilute sulphuric acid upon vanadic pentoxide in the presence of reducing agents such as alcohol, sulphurous acid, hydrochloric acid, oxalic acid, &c. The blue solution thus produced is evaporated to the consistence of a syrup and mixed with strong sulphuric acid, whereby a voluminous precipitate is at once formed. After cooling, the excess of acid is removed, the residue treated with water, care being taken to avoid rise of temperature; it is then thrown on a filter and washed with cold water, or, what is preferable, with alcohol, and dried over sulphuric acid in vacuum. The salt is of a pale blue colour, and consists of microscopic needles, which are slowly soluble in cold, and rapidly in hot water. Exposed to the atmosphere, they absorb moisture and form a thick blue liquor. After being dried in this manner for two days, the compound was submitted to analysis. At 100° it lost water, and continued to do so for upwards of twenty-four hours.

The dried sample was dissolved in water, a little hydrochloric acid added, and the sulphuric acid precipitated as barium sulphate. This precipitate passes through the filter even after long-continued digestion in the water-bath, but this difficulty can be overcome by moistening the paper with ammonium chloride solution. The excess of barium was removed from the filtrate by sulphuric acid, and the clear solution finally titrated with permanganate for the estimation of the vanadic tetroxide.

	Found.	Calculated for	
		$Va_2O_4,3SO_3,H_2O$.	$Va_2O_4,3SO_3,4H_2O$.
SO_3	51·48	52·10	50·14
Va_2O_4	35·21	36·17	34·81
H_2O (loss at 100° in 24 hours)	3·58	11·73	15·05
H_2O (difference)	9·73		
	100·00	100·00	100·00

According to the analysis, the proportion Va_2O_4 and SO_3 is—

$$\frac{35{\cdot}21}{100{\cdot}6} : \frac{51{\cdot}48}{80} = 1 : 3{\cdot}04$$

or nearly 1 mol. Va_2O_4 : 3 mol. SO_3. The amount of water found corresponds as little with the formula $Va_2O_4,3SO_3,3H_2O$ as with $Va_2O_4,3SO_3,4H_2O$. Probably the last represents the original compound, and this parts with some of the water in a dry atmosphere of low temperature. I expect to clear up this point by a further investigation.

1 (*b*). $Va_2O_4,3SO_3,15H_2O$. *Soluble* Modification.

This form of the sulphate is obtained by evaporating a solution of the crystals above described to the consistence of a syrup, and mixing the residue with strong alcohol, and in the same manner from the evaporated solution from which the crystals are separated. If the concentration is not carried far enough, the alcohol takes up a considerable quantity of the salt, and thus causes a loss; the separation of solid salt must, however, be avoided. The alcohol removes the excess of sulphuric acid, and but little of the vanadic sulphate. After repeated washings and thorough kneading, the alcohol dissolves no more of the salt, but still takes up traces of sulphuric acid. The sulphate now appears as a transparent blue mass, of wax-like consistence. It was left for some time over sulphuric acid without undergoing any change, and in this state submitted to analysis.

	Found.	Calculated for $Va_2O_4,3SO_3,15H_2O$.
H_2O (loss at 100° in 24 hours)	21·74	
,, ,, 3 ,,	0·39	
,, 125° 12 ,,	3·06	
,, ,, 3 ,,	0·17	
In the residue (difference)	14·98	40·34 39·91
Va_2O_4	24·78	24·62
SO_3	34·88	35·47
	100·00	100·00

By drying and long exposure to a temperature of 125°, this compound is not converted into the former one, the insoluble modification; the salt retains over 5 mols. of H_2O, and is still readily soluble in cold water and in dilute alcohol. The original compound, as it is separated by alcohol, rapidly absorbs moisture from the atmosphere.

The aqueous solutions of both modifications are identical in every respect. I have not succeeded in obtaining crystals from them, either by evaporation at low temperature or after the addition of sulphuric acid, nor by covering them with a layer of absolute alcohol.

The solution of the sulphate becomes dark green by the addition of ammonium vanadate, but remains clear in the cold; boiling produces dark green, almost black crusts, adhering firmly to the sides of the vessel, and reflecting the light strongly, whilst the liquor becomes lighter. Na_2HPO_4 produces with the solution of the vanadium salt a bulky greyish blue precipitate, which is readily soluble in an excess of the phosphate, and also in acetic acid; K_2CrO_4 forms a yellowish brown precipitate.

The mixed solutions of equal molecules of vanadium sulphate and potassium sulphate dry over sulphuric acid to a clear blue syrup, from which, after many days, a light blue powder separates. This is but slowly soluble in cold water, still less so in dilute alcohol, but hot water dissolves it readily. From this solution the new compound separates upon evaporation without any sign of crystalline structure; it is of very pale blue colour, and not hygroscopic. Two samples separately prepared and dried over sulphuric acid yielded the following results on analysis:—

	1.		2.	
Va_2O_4	21·43	1 mol.	25·08	1 mol.
SO_3	39·29	3·82	45·83	3·85
K_2O	21·03	1·73	23·18	1·63
H_2O (loss at 100°)	0·41	7·71	5·91	2·18
H_2O (difference)	17·84			
	100·00		100·00	

It is evident from these figures that both preparations were impure. They prove, however, that potassium has been substituted for hydrogen in the molecule of the

vanadium sulphate, and the mother-liquor from which the double salt separated, will contain acid potassium sulphate. The formula of the compound will probably be—

$$K_2(Va_2O_2)3SO_4,xH_2O.$$

The blue crystals, or the soluble modification, dried at 125°, placed in a thin test-tube and submerged in a bath of boiling vitriol or molten lead (330°), slowly lose water containing a little sulphuric acid, but the decomposition is so gradual that even after many hours the salts are still completely soluble. If, however, these salts, or the solutions from which they are prepared, are boiled with sulphuric acid for a short time they are completely converted into a heavy sandy powder of greyish green colour, the composition of which is represented by the formula $Va_2O_42SO_3$, whereas the supernatant sulphuric acid is almost free from vanadium.

2 (*a*). $Va_2O_4,2SO_3$. *Insoluble* Modification.

Prepared in the manner described, this consists of microscopic crystals, which are perfectly insoluble in cold water, even after a digestion of several months, and after long-continued boiling the water only shows a pale blue colour. This action of boiling water is very slightly increased by hydrochloric or sulphuric acid. Heated with a little water in a closed tube to 150° or 200°, complete solution takes place in a period varying from twelve to forty-eight hours, and sometimes more; but with more water a slight green sediment is formed under the same conditions. Dilute alkaline solutions decompose the compound with the formation of brown hydroxide, which is readily dissolved by acids.

The following analyses were made with samples prepared at different times. Nos. 1 and 2 were dried over sulphuric acid, No. 3 at 100°. In No. 1 the sulphate was dissolved by treatment with a dilute solution of soda, and subsequently with hydrochloric acid; the sulphuric acid was then separated with barium chloride, and the analysis carried out as described in 1 (*a*). In Nos. 2 and 3 the weighed sulphate was converted into the pentoxide by ignition, and the amount of tetroxide calculated from its weight.

	Found:—			The formula $Va_2O_4,2SO_3$ requires—
	1.	2.	3.	
SO_3	49·52	—	—	48·99
Va_2O_4.. ..	50·80	50·18	51·22	51·01
Loss at 100°	0·18	—	—	—
	100·00			100·00

2 (*b*). $Va_2O_4,2SO_3,x_2O$. *Soluble* Modification.

The insoluble sulphate, as already mentioned, is converted into a deep blue, thick, oily liquid, when heated with a small amount of water to 150° for some time. This mixes with water and alcohol, and may be boiled with either without suffering any change. The aqueous solution leaves a transparent, blue, gummy mass after evaporation over sulphuric acid, which in the course of a few weeks becomes quite hard, and is devoid of all crystalline appearance; but when moistened with alcohol and left under a loose cover it gradually assumes a crystalline texture throughout. Its solution in alcohol yields, on evaporation at low temperature, beautiful blue, well-defined crystals. I could only obtain the crystalline form from the gummy mass alluded to by the method described, and the precise manner of its formation remains as yet unexplained. I am endeavouring to prepare crystals for a crystallographical examination.

The analysis of blue crystals gave the following results:—

		The formula $Va_2O_42SO_3,10H_2O$ requires—
Va_2O_4	32·79	32·88
SO_3	—	31·58
H_2O expelled at 130° ..	26·37	35·54
		100·00

The solution of this sulphate gives, with ammonium vanadate, sodium phosphate and potassium chromate, the same reactions as the acid sulphate above described. It is not altered by sulphuretted hydrogen, but, after addition of sodium acetate and dilution with water, the gas precipitates a chocolate-coloured sulphide: it requires, however, days and weeks to complete the separation of the vanadium from the liquor.

As is already known, the vanadium sulphates are decomposed by heat into sulphurous and sulphuric acid and vanadic pentoxide, the latter of which fuses at a still higher temperature. Heated with acid potassium sulphate the vanadium sulphates fuse without decomposition; it is only at a bright red heat that they are converted into the pentoxide.

The behaviour of the first of these vanadium sulphates marks it out as an acid salt, whereas the second one bears the character of a neutral sulphate, and their symbolic representation seems best attained by the assumption of a quadrivalent radical, "Vanadyl," Va_2O_2, which leads to the following formulæ:—

1 (*a*.) $H_2(Va_2O_2),3SO_4,3H_2O$. *Insoluble* modification.—Hydric vanadylic sulphate.

1 (*b*.) $H_2(Va_2O_2),3SO_4,14H_2O$. *Soluble* modification.—Hydric vanadylic sulphate.

$K_2(Va_2O_2),3SO_4,xH_2O$.
Potassic vanadylic sulphate.

2 (*a*.) $(Va_2O_2),2SO_4$. *Insoluble* modification.—Neutral vanadylic sulphate.

2 (*b*.) $(Va_2O_2),2SO_4,10H_2O$. *Soluble* modification.—Crystallised vanadylic sulphate.

Berzelius described as acid sulphate of vanadium the compound $(Va_2O_2)2SO_4,4H_2O$. I have not succeeded in obtaining these crystals.

I am continuing the investigation of vanadium compounds, and hope for results which will elucidate their constitution.

II.—Meta-Vanadic Acid, $HVaO_3$.

I obtained this beautiful compound some years ago by treating with sulphurous acid the yellow crystals which formed by boiling the solution of the mineral copper vanadate in sulphurous acid (*Journ. f. Prakt. Chem.*, 1871, vol. iv., p. 40), after their partial oxidation by exposure to air (1).—(*Proc. Manchester Lit. and Phil. Soc.*, 1873, p. 50). Since then I have succeeded in preparing it by simpler methods. A cold saturated solution of copper sulphate is mixed with a strong solution of ammonium chloride in large excess. Ammonium vanadate in saturated solution is then added until a permanent precipitate appears, and the mixture slowly heated to 75°, when the formation of gold-like scales commences: this continues for some hours, until nearly all vanadium has separated as meta-vanadic acid, and only a trace is left in solution. The precipitate is collected on a filter, treated with dilute sulphuric and sulphurous acid (to remove small quantities of copper vanadate and red amorphous vanadic acid, which deteriorate the colour), washed with water, and dried (2.) The compound is now free from copper, but retains a small amount of ammonia in spite of repeated treatment with acids; the sample (2) when submitted to analysis contained sufficient ammonia to make it perceptible by smell on heating. This circumstance accounts for the loss by heat in the analysis being greater than the calculated amount of water. Prepared in this manner the meta-vanadic acid possesses the most brilliant colour and lustre. The bronze separates in much smaller scales of inferior colour and appearance, when dilute solutions, and particularly copper nitrate instead of the sulphate, are rapidly heated to the boiling-point. The meta-vanadic acid thus prepared more effectually resists reducing agents, as well as the solvent action of alkalies, so that boiling with ammonia or with sodium carbonate has no perceptible action. The purification is effected as above, with dilute sulphuric and sulphurous acid (3.) Meta-vanadic acid may also be obtained by adding a solution of ammo-

nium vanadate or acid sodium vanadate (the red salt) to the solution of a copper salt, separating the precipitate (which consists of copper ortho-vanadate, $Cu_3Va_2O_8$, with small excess of vanadic acid) and heating the deep yellowish brown solution, which has a strongly acid reaction to 75°. The colour becomes gradually fainter as the separation of the bronze proceeds. The filtrate from the copper vanadate contains, even if vanadiate has been used in excess, a small amount of copper, which separates with the scales, but is easily extracted with dilute acids (4).

Copper salts can be replaced by zinc salts, and probably by salts of any heavy metal which forms a sparingly soluble ortho-vanadate, and is not precipitated by ammonia in the presence of ammonium salts. Ortho-vanadates of copper and zinc are partially converted by long-continued boiling with ammonium chloride into meta-vanadic acid.

The materials for the analyses were weighed after drying in the water-bath, then heated to redness; the loss calculated as water, and the residue as vanadic pentoxide. The residue of No. 1, which was prepared from impure materials, was fluxed with sodium carbonate, dissolved in water, and a small quantity of insoluble matter, consisting of lime and ferric oxide separated; the filtrate was acidulated with acetic acid, and lead acetate added; the precipitated lead vanadate was washed with water, and decomposed with sulphuric acid and alcohol: upon evaporating the solution of vanadic acid and igniting the residue, the vanadium pentoxide was left in a pure state.

	Found.				Calculated for $HVaO_3$.
	1.	2.	3.	4.	
H_2O (loss by ignition)	8·73	9·12	9·22	9·31	8·97
Va_2O_5	91·06	90·88	90·78	90·60	91·03
Impurities (CaO, Fe_2O_3)	0·21	—	—	—	—
	100·00	100·00	100·00	100·00	100·00

Meta-vanadic acid is a highly hygroscopic substance. It suffers no change at 150°; at higher temperatures it loses water and leaves vanadic pentoxide, which fuses at a still higher temperature.

I am still engaged with the study of the formation of this remarkable form of vanadic acid, which resists chemical reagents to a surprising extent; meanwhile I communicate some experiences that may be of interest.

The filtrate from the copper vanadate (4) yields, on heating, less of the meta-acid the longer it has been kept, so that after eight or ten days it remains clear on boiling. This change is not indicated by any visible alteration.

The original liquor evaporated in a thin layer at low temperature leaves a crystalline residue: this forms a clear solution with cold water, which, heated to 75°, deposits meta-vanadic acid in scales.

The same liquor parted, on the dialyser, with all the salts within five days, whilst but little of the vanadic acid penetrated the parchment paper. The vanadic acid was left in a new soluble modification; its solution yielded no scales on boiling, but remained clear, and deposited red amorphous vanadic acid after considerable evaporation.

The meta-vanadic acid possesses properties which recommend it as a substitute for gold-bronze. With care it can easily be obtained of beautiful colour and lustre, almost equal to gold, and as a very fine powder, mixing readily with gum or oil. It is in no way affected by the atmosphere or by moisture.

Macclesfield, May, 1876.

FORMATION OF OZONE BY THE CONTACT OF PLANTS WITH PEROXIDE OF HYDROGEN.

By S. COHNÉ.

If a fresh stem of a plant is put into a test-tube filled with a weak solution of peroxide of hydrogen, the latter decomposes, and almost immediately the oxygen bubbles are seen rising to the surface, and a portion of the oxygen will be found to be ozone, which may be proved by the known test of a strip of paper saturated with iodide of potassium.

When the moistened paper is put on the top of the tube without touching the water in the tube, the paper turns brown.

If a flower with its stem and leaves is put into the tube, the decomposition of the peroxide will be caused by the entire plant, but in the same way as the absorption of the plants, when in a growing state, is most active at the sponges or hairs which terminate the roots, so decomposition of the HO_2 mostly takes place at the end of the stem where it is cut through, also at the leaves.

The presence of the ozone may also be proved by its density. If the tube is shaken a little, the active or ozonised oxygen rises more freely from the bottom of the tube, because the ozone is more dense than ordinary oxygen. The decomposition goes on gradually, and if a bunch of flowers, instead of being put into a glass filled with water only, is put into a glass filled with a weak solution of HO_2, the room may be filled with ozone in a more simple and easy manner than by any other known process.

If a strong solution of HO_2 be used, the active oxygen evolves itself tumultuously, and if an electrophore is placed near it, a slight deflection takes place, proving that there is chemical reaction going on, but the flowers then very soon fade.

ON THE ACTION OF CERTAIN KINDS OF FILTERS ON ORGANIC SUBSTANCES.

Part II.

By J. ALFRED WANKLYN.

In continuing my investigation into the action of the silicated carbon filter, I have proceeded to experiment on solutions containing a by no means infinitesimal quantity of organic substance, and, as will be apparent from the following details, have obtained a very striking result.

In these experiments I employed a rather larger filter than before, viz., a filter containing a cake of silicated carbon 6 inches in thickness, and the filter was quite new.

Experiment I.—Into a quantity of boiled London water (which yielded 0·00 milligramme of free ammonia and 0·04 milligramme of albuminoid ammonia per litre) I placed a weighed quantity of acid sulphate of quinine. In this manner a large volume of dilute solution of acid sulphate of quinine of such a strength that one litre contained 14·2 milligrammes of the acid sulphate was prepared. Before making the experiment with the filter I subjected some of this dilute solution of quinine to the ammonia process, and obtained from 1 litre—

Free ammonia	trace
Albuminoid ammonia	0·48 m.grm.

The solution was then poured on the filter, care having been taken beforehand to empty out all the water which was in the filter.

The first litre of filtrate was thrown away, inasmuch as I considered that the first litre would consist of water displaced by the solution of quinine. Successive half-litres of filtrate, as they came through the filter, were analysed with the following results:—

	Milligrms. per Litre.	
	Free Ammonia.	Albuminoid Ammonia.
No. 1	0·24	0·04
No. 2	0·14	0·04
No. 3	0·15	0·04
No. 4	0·14	0·02

The circumstance of the low yield of albuminoid ammonia not being confined to the first portions of filtrate, is a demonstration that I had eliminated the influence of dilution by water previously occupying the pores of the

filter, and the result may be accepted with confidence that a solution of quinine, which yielded 0·48 m.grm. of albuminoid ammonia per litre, was so purified by a single filtration through 6 inches of "silicated carbon" that after filtration it yielded only 0·01 or 0·02 m.grm. of albuminoid ammonia per litre.

Encouraged by this result I prepared a much stronger solution of quinine, viz., a solution containing 118 m.grms. of acid sulphate of quinine per litre. The acid sulphate of quinine which I employed was in large crystals, and had been previously investigated and found to contain 21·1 per cent of water of crystallisation. As the reader will observe the above-mentioned solution contained 8·26 grs. of the salt to the gallon of water, and such a solution is quite bitter to the taste.

Experiment II.—The above described solution of quinine (118 m.grms. of acid sulphate of quinine in a litre of water) was passed through the filter, and after rejecting the first litre of filtrate, examinations of the further filtrate were commenced. The filtrate yielded—

Milligrms. per Litre.	
Free Ammonia.	Albuminoid Ammonia.
0·20	0·02

This result was further confirmed by evaporating a quantity of the filtrate down to dryness and weighing and igniting the residue. As will readily be understood, a solution containing as much as 8¼ grs. of sulphate of quinine per gallon is strong enough to be dealt with by simple means, and accordingly I experimented in that manner with the solution before and after filtration, and got perfectly satisfactory results. Finally, I tasted the filtrate and found that all bitterness had gone away.

Thus I have arrived at the startling result that by a simple filtration through 6 inches of silicated carbon a solution of quinine, containing 8¼ grs. of the acid sulphate per gallon of water, is totally deprived of quinine. I am extending the investigation to non-nitrogenous organic substances, and have operated upon a 10 grain to the gallon solution of cane sugar. Action there seems to be; but, so far as I am able to judge at present, it is neither so rapid nor so complete as in the instance of quinine and nitrogenous substances generally.

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 255.)

Chlorine, Bromine, Iodine, and Fluorine.
By Dr. E. MYLIUS, of Ludwigshafen.

WHERE two muffle furnaces are in use with a total weekly yield of 8000 kilos. of salt-cake on the system of condensation just mentioned, 15 metres in height and 2·3 metres in the square (interior measurement) suffice for the production of a strong acid. At any rate the condensation is so perfect that in the second, or "washing tower," which may measure something less in the clear, the acid obtained does not exceed the strength of 1° B., which may be let pass away in each channel, if it is not preferred to let it pass down in the second or condensation tower. The acid from the first tower may be further strengthened in the first trough—in which most of the accompanying sulphuric acid is condensed—with a view to its utilisation in the manufacture of chloride of lime.

Particular attention must be paid to the towers when fitted up. They are filled either with bricks or coke, the latter material being preferable on account of its larger surface, greater power of resisting hydrochloric acid, and its less weight. Sometimes a combination of both materials is made, the bricks being placed below and the coke above. In order to distribute the water equally among the contents of the tower we employ either a rocking trough or Segner's water-wheel. The coke must be filled in neither too compact nor too loosely; the former error impeding the movement of the gases, and the latter leading to the subsequent settlement of particular portions. In both these cases the gas selects the more open passages, and a large part of the tower may be thrown out of action. The towers may also deviate from the perpendicular, when the water runs down one side alone, leaving the other nearly dry, and as these parts allow the freest passage to the gases the actual absorption becomes very small.

A very convenient arrangement for condensation is the combination of coke towers and Woolff's bottles, introduced at Stolberg and elsewhere. The gases escaping from the salt-cake pans and muffle furnaces, considerably cooled in passing through a long series of earthenware pipes, are led into a long row of Woolff's, tubulated on both sides at a fourth of their height reckoning from the bottom and connected by caoutchouc tubes well secured with cement; thus the liquid in all stands at the same level. From these the gases enter the coke towers, whence the condensed acid flows back into the Woolff's bottles to be there strengthened by the muriatic acid gas continually streaming over it, and thus reaches the required strength (Hasenclever).

In England the condensation of the hydrochloric acid is carried so far that whilst in the first year of the operation of the Alkali Act, 1·28 per cent escaped, in the second the loss was reduced to 0·88 per cent, in the third to 0·73, and in many works as far as can be ascertained the condensation is perfect.

(To be continued)

* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzenends."

NOTICES OF BOOKS.

Discursive Chemical Notes in Rhyme. By the author of the "Chemical Review," A. B. Part I. The Non-Metallics. London: Van Voorst.

THE example of Sir Humphry Davy notwithstanding, chemists are not generally credited with poetical tendencies. The philosopher of Penzance, too, when courting the Muses found his subjects outside the laboratory; but the author of the little work before us, with greater daring, gives us in verse the chemistry of the non-metallic elements, and despite the refractory and unpromising nature of the subject the result is very far from a failure. Whether, if he continues his task, he may some day succeed in weaving the neo-chemical nomenclature of organic compounds into easily flowing verse the future can alone decide. But this poem is not merely a "philosophy in rhyme" dealing with the hard, dry facts of the science, it is also a satire. Chemistry has its theories, perhaps its dreams, insisted upon the more strongly in the exact ratio of their absence of solid foundation. Chemists, too, like other men—and more than most men—have their rivalries, jealousies, feuds, and cliques. Even the prospect of finding their duties and the accompanying emoluments gradually absorbed by the engineers is not enough to compel them into unity. There are those who say in their actions, if not *totidem verbis*, "perish the profession, if we may not rule it."

There is consequently good scope for satire, even of a sterner and more uncompromising type than what is introduced in these pages. Our author, even where he points out what is unsatisfactory, is good natured and says of himself, not untruly:—

"To hurt one's feelings I could no more write
Than walk to the Land's End like Walter White."

As a specimen of his satirical vein we quote the following:—

"But as I always wish to be particular,
And act in concert with the modern school,
I must not be atomic, but molecular,
Or Williamson might take me for a fool;
So in this wise our formula we spell
Twice KCl, and ditto KCl.
Plus six of oxygen or $3O_2$
(I think I'm right, but yet feel rather hazy;
For after thirty years or so the new
Strange formulæ will tend to drive one crazy,
And make him half inclined to write a letter
To some great gun and say 'The old are better').
I took up Frankland's book the other night
('Tis very clever, anyone may see),
And, musing, wondered could a chemist write
So quaint a work and out of Bedlam be:
And all to please his college-boys (the Turks!)
With graphic formulæ like fireworks—
With h's small and very fat round O's,
Conjointly placed near apoplectic C's
In curious brackets, which, we may suppose,
Are only there to irritate and tease.
I gave it up when reading this queer type,
And, growing sorrowful, smoked half a pipe."

Of "hydroxyl" the author exclaims somewhat profanely, but aptly—

"Yet do not, if you love me, blame the muse,
But rather this damn'd radicle abuse!

After paying a graceful tribute to the memory of Faraday, Graham, and Liebig, the poet bids us—

"Then cheer up, brothers; there are many yet,
Thank God! amongst us who can hold their own.
Great Time hath wrought its change and brought regret
For those who once within our circle shone:
Mourn as we must the many who are fled,
Gilbert is with us, though his Pig is dead."

Perhaps it is as well, both for Dr. Gilbert and the Society, for in these days it is hard to name any possible experiment upon or with animals which may not be construed as vivisection. Therefore let this "Fellow" rest in peace.

To make further quotations would hardly be just to our author, but we think the specimens we have given may make our readers inclined to enquire further. We believe that, like ourselves, they will conclude that the pen of this anonymous poet will be of service both to the science and to the profession.

The Miners' Curfew and other Matters, Social and Political. By LEWIS THOMPSON, M.R.C.S. Newcastle-upon-Tyne: *Daily Journal* Office.

THIS pamphlet contains a description of an arrangement which is to give warning, by ringing two or three bells "as soon as ever the air that surrounds it becomes dangerous to human life from an accumulation either of fire-damp or choke-damp." The principle is that of the well-known electric bell, the circuit being closed and the bells caused to ring by a derangement in the equilibrium of a balance. Two oiled silk bags are taken, of a spherical form, and equal as nearly as possible in size and weight. "One of these bags contains no air, but is compressed into the shape of a plate, so as to present on each side a surface equal to the area of a great circle of the other bag, which, however, is filled only to the extent of four-fifths with atmospheric air, and then securely tied. These bags are to be hung at the two arms of a balance, and carefully counterpoised." The air in the full bag, of course, will expand and contract with the surrounding air, and hence will not be affected by barometric or thermometric changes. But if the air becomes mixed with a lighter gas, such as light carburetted hydrogen, the filled bag will descend, the circuit will be closed by means of a bent wire, and the bells will begin to sound. If, on the other hand, the air is rendered heavier by an admixture with carbonic acid, the other arm of the balance descends, and the bells are equally set in action. The bags are of oiled silk, like that used for balloons, and each of them is to contain about 250 cubic inches of air.

This idea, it must be admitted, is highly ingenious. As the author remarks, the balance with its bags must be placed close to the spot where the men are engaged. It must, at the same time, be secured from currents of air, from injury by falling rubbish, and from being foolishly played with.

A succeeding portion of this pamphlet treats of the manufacture of illuminating gas without the use of coal. Since his former pamphlet upon coal-gas, the author has received fourteen letters from persons who describe themselves as "interested in gas-making," and who express a hope that he will not "lend himself to gas agitation." His proposal is to heat charcoal in a slow current of atmospheric air, and pass it through a receiver filled with benzoline of sp. gr. 0·704, at the temperature of 50° F. The process, as is evident, is free from nuisance, and can be easily managed in a private house. As regards the cost, the author cannot speak definitely, because he has found the prices both of charcoal and benzoline vary to the extent of 300 per cent.

To get rid of gas companies, who in places where the ratepayers have not been wise enough to take such matters into their own hands generally have contrived to obtain a dangerous amount of power, and who too often use it in a somewhat high-handed manner, would be a boon of no small magnitude. But at present the abolition of the gas manufacture, with all its admitted drawbacks, would be most unpleasantly felt by those branches of industrial chemistry which utilise its by-products.

The remaining parts of this pamphlet, though by no means devoid of value, cannot be consistently noticed in the CHEMICAL NEWS.

CORRESPONDENCE.

THE CHEMICAL SOCIETY.

To the Editor of the Chemical News.

SIR,—The Chemical Society is undoubtedly passing through a crisis, the satisfactory termination of which will not be facilitated by the use of such expressions as "indiscriminate or reckless blackballing," "blackballing clique," "meaningless and ill-natured blackballing," &c. I am one of those who believe that blackballing has been carried somewhat too far, but I also believe that it has been done from pure motives, however mistaken they may be; and if this is so, surely it is better to meet the party by argument, and not by abuse, which will only recoil on those making use of it.

As far as I can learn, the present agitation is caused mainly by the conviction, shared by many, that the Fellowship of the Chemical Society is, to the majority of English chemists, the only distinction within reach which might stamp them as chemists, and that such stamp should be made an honour worth having. Entrance into the Society has, however, it is argued, been made so easy of late that its Fellowship has ceased to be any real distinction. It is therefore proposed to restrict entrance to real chemists only, and thus restore the prestige formerly connected with the letters F.C.S. On the other extreme side, it is said that the Chemical Society has been established for the general promotion of chemical science, and not for the purpose of stamping its Fellows as chemists; that for the promotion of such object much money is wanted, and that all who are willing to pay assist the Society in doing its legitimate work, and are therefore entitled to be admitted as Fellows.

Now it appears to me that much may be said on both sides of the question, and that at any rate it cannot be settled by the use of harsh terms. Would it not, then, be best for those who desire alteration to hold a public meeting, thoroughly discuss their side of the question, and, if possible, pass resolutions embodying the changes proposed? Such resolutions should then be laid before the

Council, which, I doubt not, would take them into careful consideration, and, if thought desirable, would further take the opinion of the Society at large on the subject.

The party, whichever it might be, which would then find itself in the minority would, it is to be hoped, have sufficient good sense and good feeling to conform to the clearly expressed wish of the majority.—I am, &c.,

A. DUPRÉ.

Laboratory, Westminster Hospital,
London, S.W., June 29, 1876.

To the Editor of the Chemical News.

SIR,—You have very justly reminded your readers that systematic blackballing is not a new thing in the Chemical Society, and that in 1867 there was an outbreak of blackballing which compelled the Council of the Society to take action. In point of fact systematic blackballing is the form in which the dissatisfaction which generally prevails in the Chemical Society makes itself manifest from time to time.

The structure of the Chemical Society, like that of other so-called learned societies, is very peculiar. Nominally the Chemical Society is a republic of the most democratic character, inasmuch as the Council and officers hold office solely by virtue of a majority of votes given by the Fellows, and each Fellow has only one vote.

Really and in practice, however, the elective power of the Society remains permanently in abeyance; and the Council of one year re-elects itself and its nominees to form the Council of the next year. It is notorious how thinly the anniversary meetings are attended, and that not one-tenth (and probably not one-twentieth) of the 600 or 700 Fellows of the Society take any part in the election of the Council of the Society. Inevitably this state of things develops "officialism," and leads to all those evils the existence of which is announced by the systematic blackballing which is so prevalent in the Chemical Society.

The best remedy would be to induce the Society as a whole to vote for its Council. Failing that, it would be wise to draw lots for the Council, which might afterwards choose the President and officers. It does seem to me that a sham annual election must be a source of danger to any Society.—I am, &c.,

J. ALFRED WANKLYN.

To the Editor of the Chemical News.

SIR,—"History is said to repeat itself." Of all our oft-repeated phrases this one is perhaps the most illusory. With equal truth the same might be said of waves or volcanic outbursts. But just as the ripple may be the precursor of the tempest, the underground rumbling may betoken a violent eruption.

In the Chemical Society in 1867 signs of dissatisfaction were manifest; we are told that a "somewhat widespread dissatisfaction" now exists, and relating too to the same cause—that is, to the election of Fellows. The '67 agitation was productive of only a small amount of good, but it by no means follows that the '76 or '77 movement will be of so little import to the chemist. Change of time has brought change of aspirations. Intestine wars among the Fellows are a natural consequence of their heterogeneous character. The idle never yet agreed well with the industrious. The chemist and non-chemist cannot be expected to blend and harmonise one with the other. This is well illustrated by the so-called "organisation" movement, one of the objects of which is to sift these incompatible elements.

The only scheme before us relating to the subject is the one published in the CHEMICAL NEWS (vol. xxxiii., page 240) by the "clients" of Mr. Pettengill, which I believe to be the most suicidal and impracticable possible to have been devised.

The only part of the scheme which immediately concerns the present generation of chemists, and on which I shall offer a few remarks, is a clause relating to "persons now employed as chemists." I would urge every chemist to read this carefully, and then ask himself whether he be eligible for the membership of the proposed Institute. Many of my friends, veterans of upwards of ten years, would certainly be excluded, and I doubt whether it would be possible for the gentlemen who sat on either side of Prof. Abel at the organisation meeting at Burlington House to squeeze in except by a side door, which, to say the least, renders the thing ridiculous.

In a former communication I pointed out what I considered to be the great desideratum, namely, *unity amongst chemists*, which I thought might be effected by the time-honoured Chemical Society. Dr. Wright's elaborate summing up has so far discountenanced this idea that I think the time has come for chemists most sincerely to consider the advisability of bringing this about by independent action. The success of any movement to found a *representative* chemical corporation must ultimately depend upon its receiving the support of the present generation of chemists. To do this effectively all chemists, scientific or technical, must be invited to join and assist. It is premature to lay down any unauthorised restrictions as to age or other qualifications, and it would be invidious —nay, impertinent—for Chemist A to sit in judgment on the qualifications of his brother B.

Again, any scheme, to be successful, must be comprehensive, and sufficient to *attract* all men now engaged as chemists, or it will most assuredly be annihilated by the successful opposition of those whom it would vilify, ostracise, and threaten with ruin.—I am, &c.,

ALFRED TRIBE.

Dulwich College, July 4, 1876.

To the Editor of the Chemical News.

SIR,—Now that the subject of organisation amongst chemists is being so largely discussed in the columns of the CHEMICAL NEWS, I will beg permission to make known to your readers some of the details of a case in which the initials F.C.S. appear in an advertising pamphlet in a manner which cannot but be considered as most derogatory to the science.

The particular case to which I am about to direct attention has been already brought under the notice of the Chemical Society on the occasion of the last anniversary meeting; but, as the pamphlet was not at the time at hand, the speaker (Mr. R. J. Friswell) could give no details. As the pamphlet is accessible to all, there is no occasion to suppress names. To quote from the wrapper —"J. N. Hearder's Guide to Sea Fishing.....and Descriptive Catalogue of his Prize River and Sea Fishing Tackle, Cricket, Archery, Croquet, Umbrellas, Parasols, &c." The above is repeated, with some few additions, on the title-page, which concludes with "Lecturer on Chemistry and Experimental Physics, D.Sc., Ph.D., F.C.S." On page 52 we have a catalogue of "philosophical apparatus" (immediately following the list of umbrellas and parasols), and after this the public is informed that "J. N. Hearder, D.Sc., Ph.D., F.C.S., may be consulted on all subjects relating to the practical application of science to the arts and manufactures. He is also prepared to deliver lectures on any branch of science to scientific institutions." On the opposite page, by way of antithesis, we read—"Smiths' work in general; gas-fitting in all its branches; bell-hanging, &c." The author here describes himself also as a "warming and ventilating engineer."

Even if the demands upon your space permitted, further comment upon these extracts would be unnecessary.

They plead for themselves, "like angels, trumpet-tongued," in favour of *re*organisation.—I am, &c.,

R. MELDOLA.

Belle Vue House, Twickenham, July 3, 1876.

[The discussion on "The Chemical Society" and the "Organisation" movement, having occupied a great deal of our space during the last few weeks to the exclusion of

other important matter, we are compelled to decline to insert any more letters on the subject for the present, unless, indeed, our correspondents have any new information to give, and then it will be necessary for the letters to bear the writers' names.—*Ed.* C. N.].

ANALYSIS OF PEROXIDE OF MANGANESE.

To the Editor of the Chemical News.

SIR,—The analysis of a sample of peroxide of manganese, given by Dr. Phipson in the CHEMICAL NEWS (vol. xxxiii., p. 243) is of interest from the large number of elements found. There is one point on which I (and possibly other of your readers) should like further information. The author writes:—"The quantity of MnO_2 being calculated in the usual manner, the rest of the manganese was considered as Mn_2O_3, though there are doubtless small quantities as MnO." As I frequently require to make complete analyses of manganese ores, I am curious to know how Dr. Phipson distinguished the MnO_2 from the Mn_2O_3. Both these oxides exercise an oxidising action, though of course the available oxygen of the latter is only half that of the former. As all the methods of determining MnO_2 (as distinguished from MnO) with which I am acquainted are based, directly or indirectly, on its oxidising power, how did Dr. Phipson distinguish it from the remaining oxide of manganese if the latter was Mn_2O_3? Is it not evident that the oxide which was not recognised by any process of "chlorimetry" must have been MnO? Is it not impossible to distinguish analytically between Mn_2O_3 and $MnO+MnO_2$? If so, Dr. Phipson has counted his oxygen twice over.—I am, &c.,

ALFRED H. ALLEN.

Sheffield, July 3, 1876.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances, de l'Academie des Sciences. No. 22, May 29, 1876.

Atomic Constitution of Bodies.—M. de St.-Venant.—The author concludes that we cannot, without placing ourselves in contradiction with the totality of celestial and terrestrial phenomena regard atoms as corpuscles formed of hard and continuous matter, but that there is nothing contradictory in considering them as material points endowed with all the properties, save extension, which we observe in visible and tangible bodies.

New Remarks on the Real Existence of a Matter formed of Isolated Atoms comparable to Materials Points.—M. Berthelot.—The conception of a single and fundamental kind of matter, of which the multiple states of aggregation constitute the elementary bodies that we know, with their specific properties—a conception to which eminent minds give their adhesion—seems to imply that the atomic masses of our elements are far removed from the condition of true atoms.

Salts Formed by the Peroxide of Manganese.—M. E. Fremy.—The author shows that the peroxide of manganese under different circumstances may behave either as indifferent, acid or basic, and forms salts in which he considers that it plays the part of a base.

Examination of the Possible Mechanical Action of Light: Study of the Radioscope of Mr. Crookes.—M. A. Ledieu.—The fact that the luminous rays produce generally little heat would show precisely that the *vis viva* which the luminiferous vibrations of the ether give off must tend to convert itself almost entirely into motion.

Radiometer of Mr. Crookes.—M. W. de Fonvielle.—The experiments executed by M. Darlu de Roissy and myself in the photometric laboratory of the gas works at Vilette appear to us to confirm the opinions put forward by Mr. Crookes. The procedure which enabled us to change at will the direct movement to the right into an inverse movement to the left seems to agree with the arguments of this eminent chemist before the Royal Society of London. We obtained the normal rotation under the action of radiant heat, but after having left the radiometer exposed for five minutes to a temperature of 45° C. we plunged it rapidly into a bath of cold water at 15° C. The rotation to the right ceased, the instrument stopped for a moment, and then began to revolve to the left with a rapidly increasing speed, which reached a revolution and a half per second. This inverse movement ceased almost as quickly as it had begun. At the end of half a minute the movement to the right re-commenced under the action of the solar rays which fell upon the absorbent surfaces of the radiometer in the midst of the liquid mass, and without the possibility of heating by conduction.

M. Fizeau, with reference to this communication, remarked that the conclusions of the author in favour of the existence of an impulsive force in the rays of light, seemed to him to require the most formal reservations. The ingenious instrument of Mr. Crookes seemed to be in reality a thermic apparatus, in which the rotation, with all its circumstances, may be simply ascribed:—(1) To a slight excess of temperature acquired by the discs as compared with the ambient medium under the influence of light. (2) To the inequality of the emissive and absorbent powers of the two opposite surfaces of each disc, the one blackened and the other polished. (3) To the inevitable presence in the apparatus of a small quantity of elastic fluid (gas or watery vapour), the layers of which close to the blackened surface may acquire a slight excess of elastic force sufficient to propel the discs whose mobility is extreme. Certain inverse movements temporarily produced by cold will be the analogous results of the same causes. Moreover, M. Fizeau, at the request of several members of the Academy, made in their presence, at the end of the sitting, certain experiments with the instrument. He showed that if a stream of solar rays, limited by a screen, were thrown upon the disc so as to strike merely the polished surfaces of the discs the rotatory movement was still produced, but in such a direction that each disc moved to meet the solar rays instead of retiring from them, as ought to take place if the motion were the result of an impulsive power of light. Previous experiments have shown, further, that this result does not depend on accidental reflections in the interior of the apparatus.

Charge assumed by the Disc of the Electrophorus.—M. E. Douliot.—The charge received by the disc, and which it carries away when raised by its isolating handle, is proportional to its radius.

Theory of Spectra; Observations on the Last Communication of Mr. Lockyer.—M. Lecoq de Boisbaudran.—Reserved for insertion in full.

Constitution of Propylenic Monochlorhydrins, and on the Law of Addition of Hypochlorous Acid.—M. L. Henry.—Not suitable for abstraction.

Quino-acetate of Calcium.—M. E. Gundelach.—The author examining a commercial quinate of calcium found that it was a double salt, formed of equal molecules of quinate and acetate of lime.

No. 23, June 5, 1876.

Thermic Formation of Ozone.—Ozone is a body formed with absorption of heat, which it evolves in its oxidising actions—a fact which explains the superiority of its energy to that of ordinary oxygen. This excess of heat or of energy has been stored up under the influence of electricity, an excess remarkable because we have here the formation of a body more condensed than that from

which it is produced, although condensation, in general, causes the liberation and not the absorption of heat, as takes place here. This is probably the only instance of a gas supposed to be simple and yet capable of presenting two distinct isomeric modifications in the gaseous state.

Absorption of Free Nitrogen by Organic Matters at Ordinary Temperatures.—M. Berthelot.—The author finds that free nitrogen is absorbed at ordinary temperatures by organic compounds under the influence of the electric *effluve* (silent discharge). He insists on this new cause of the fixation of atmospheric nitrogen in nature. It produces condensed nitrogenous compounds belonging to the class of the humic principles. However limited may be the effects at each moment, and on each particular spot of the earth's surface, they may nevertheless become considerable, in virtue of the extent and continuity of a reaction universal and never ceasing.

Origin of Organic Ferments.—M. L. Pasteur.—This paper is an extract from a work about to appear under the title "Etudes sur la Bière." The author combats M. Fremy's hypothesis of "hemiorganism," and quotes Dr. Tyndall's remarks on the writings of Dr. Bastian.

Examination of the Possible Mechanical Action of Light: Study of the Radiometer of Mr. Crookes.—M. A. Ledieu (continuation).—The author having explained his theory to M. Fizeau, this eminent academician proposed an experiment by polarising a pencil of rays. In this manner, in fact, in accordance with his theory, we ought to obtain a minimum impulsion, or none at all when the plane of polarisation is made to pass along the axis of the radiometer. On the contrary, the maximum impulsion should be obtained at 90° from the first position. This experiment was made with an excellent instrument by M. Alvergniat, but it gave no conclusive result. M. Fizeau then caused an ordinary pencil of rays to fall exclusively upon the blackened discs, and thus obtained a movement more accelerated than when the pencil fell at once upon both kinds of surfaces. He then operated in an analogous manner upon the bright surfaces, taking care to incline the pencil of rays so that no reflection might be thrown from the polished surfaces upon the black ones. The instrument continued to revolve, but with a reduced speed. This latter experiment would lead us to condemn all radiant influence, since this would attract in one case and repel in the other. The author's theory would therefore seem confounded by such a result, as well as every other explanation based upon the doctrine of emission. But on examining more closely, we are led to remark that in all the experiments related there is reflection of light upon the glass of the globe, and that, besides, when these rays are polarised, the plane of polarisation, after reflection, is no longer presented in the same direction as regards the faces of the discs. We must then conclude that further experiments are absolutely required to elucidate the question. The author, then, quoting the opinion of M. Fizeau, given in the present number of the CHEMICAL NEWS, continues—"This opinion, emanating from so distinguished a *savant*, must assuredly be taken into high consideration. Nevertheless, considering the regularity, the definite character, and the certainty of the revolution of the instrument, always in one and the same direction, the explanation of M. Fizeau does not satisfy us entirely, and the debate does not seemed to be closed. He then suggests the following experiments:—Illuminate an ordinary radiometer, *i.e.*, with discs alternately polished and blackened in the direction of its axis. The instrument ought to revolve in the same direction as when the pencil of rays illuminates the axis vertically, and the rotation even ought to be accelerated. Second. Construct an apparatus all the discs of which shall be left bright so as to reduce to a minimum the influence of the reflections upon the glass; then to throw a pencil of rays upon the disc situate on one and the same side as relates to the axis of the instrument. If the rotation is really due to the mechanical action of light the instrument will turn as if the discs were repelled by the luminous rays. M. Ledieu does not hold that the movements of the earth, as a whole, can be effected by the solar radiations. He considers, however, that we have here a very natural explanation of the form of the tails of comets.

Report on several Memoirs by M. Allard relating to the Transparence of Flames and of the Atmosphere, and to the Visibility of Lighthouses with Flashing Lights.—MM. Jamin, Puiseux, and E. Becquerel.—M. Allard finds that the luminous intensity of the flames of lamps with concentric wicks increases more rapidly than the consumption of oil, and equally with the visible surface. The mean value of the coefficient of the transparency of flame, for a thickness of 1 centimetre, is expressed by the number 0·80.

Law of Dulong and Petit.—M. A. Terreil.—M. Terreil holds that there are only two phases when bodies possess their true absolute specific heat. The first of these is the moment when the body is in the gaseous state, and the other that when it has lost this state, no matter whether it has become liquid or solid. He admits, besides, that at the moment of these two phases the forces which modify the absolute specific heats have not yet come into action. In order to distinguish the specific heats, as he understands them, from the admitted specific heats, he gives them the name of chemical specific heats. He finds that the specific heat of bodies doubles when they cease to be gaseous.

Perturbing Influence of Neighbouring Masses on the Form and the Disposition of Crystals.—M. Ch. Brame.—Not adapted for abstraction.

Inconvenience of Ropes of Copper Wire as Lightning Conductors.—M. R. Francisque-Michel.—The author holds that a lightning-conductor should have at least a section of 350 to 400 square millimetres.

Influence of Certain Salts of Lime on Saccharimetry.—M. A. Müntz.—The author concludes that the rotatory power of cane-sugar in presence of a given salt is sensibly constant for one and the same quantity of salt dissolved in one and the same volume of liquid, whatever may be the ratio of the salt to the sugar. The decrease of rotatory power is, up to a certain point, proportional to the quantity of salt dissolved.

Derivative of Acetyl-acetic Ether: Oxy-pyro-tartaric Acid.—M. E. Demarçay.—Not suited for abstraction.

Combustion of Organic Matters under the Double Influence of Heat and Oxygen.—M. D. Loiseau.—For the complete combustion of volatile products it is necessary to operate in tubes whose interior diameter is so much the greater as the current of oxygen is more feeble.

Metallisation of Organic Bodies to render them fit to receive Galvanic Deposits.—M. P. Cazeneuve.—The author saturates the bodies in question with alcoholic nitrate of silver, which is then reduced by the solar light, or preferably by means of mercurial vapours.

Determination of Sulphuric Acid and Soluble Sulphates by means of Standard Solutions.—M. H. Pellet.—The author first precipitates the sulphuric acid by chloride of barium in excess, precipitates the excess of chloride of barium with yellow chromate of potash, and finally determines the chromate with standard solutions of protochloride of iron and permanganate of potash.

Les Mondes, Revue Hebdomadaire des Sciences, No. 7, June 15, 1876.

The Radiometer of Mr. Crookes.—M. Trouve.—I am desirous of knowing if Mr. Crookes has given a theory, or rather a logical definition, of the movement of his instrument in presence of light. On my part, I find no satisfactory explanation of this phenomenon save in a comparison with the theory of the electric mill. I ascribe, therefore, the movement to the diffusion of the fluid, and

not to a direct action exerted by light. What confirms me in this view is that this apparatus, which works as well with light as with dark heat, behaves with the latter just as a secondary couple behaves with electricity—that is to say, it gives back to a certain extent the mechanical action which it has received. If the radiometer is exposed to the sun, it takes an accelerated movement in one direction. But if this motion is abruptly stopped, and the instrument withdrawn from the source of light, it immediately begins to turn in the opposite direction.

Reimann's Farber Zeitung, No. 21, 1876.

M. Prinvault has communicated to the Industrial Society of Rouen a process for obtaining a scarlet, the shade known as Persian red, from the chromate of lead. If carbonate of lead is digested with a cold solution of 1 part of the neutral chromate of lead in 50 of water, so that two equivalents of the former may react with one of the latter compound, there is obtained in two days a crystalline precipitate of basic chromate of lead. If the supernatant liquid is boiled, it evolves carbonic acid, since bicarbonate of potassa is present, and is converted into a solution of potash, which decomposes a part of the red precipitate, so that it takes a violet-red colour, whilst the liquid turns yellow. The precipitate is too dull to be of any value. If it is washed with water, and treated with 4 per cent of its weight of dilute sulphuric acid (1 in 100), adding the acid slowly and stirring, and then neutralising with a dilute solution of soda, there is formed a mixture of sulphate and of basic chromate of lead, the colour passing into a fiery vermillion. The quantity obtained is about equal to the carbonate of lead employed. According to M. Prinvault, nitric or acetic acid may be used instead of sulphuric, but not hydrochloric. The proportions he employs are 25 grms. neutral carbonate of lead, with 10 grms. neutral chromate of potassa. He digests two days in the cold, boils for half an hour, filters, washes the precipitate, and treats it with 1 grm. of sulphuric acid diluted with 100 grms. of water. The new red cannot be fixed with albumen on account of its crystalline texture. It may, however, be possible to convert chrome orange into Persian red upon the fibre.

The Berlin daily papers are very busy with another supposed case of poisoning from the lining of a hat. A Government official, shortly after buying a new hat, was troubled with a very disagreeable eruption on his forehead. The affair is in the hands of the authorities.

Purpurin.—According to F. de Lalande's French patent purpurin may be obtained as follows:—100 parts alizarin and 100 of dry arsenic acid are heated with 1000 parts of sulphuric acid to 150°, until a sample taken out gives a deep red colour with soda. He then dilutes with 30 volumes of water, heats, and filters. The residue is used for dyeing. Instead of arsenic acid may be used antimonic acid, peroxide of manganese, or stannic acid.

Rosenstiehl has obtained a colouring matter in yellow metallic lamellæ by acting upon dry artificial alizarin with nitrous acid. With alumina it dyes yellow, and with iron mordants a red-violet, both which colours can be brightened with boiling soap lyes. It dyes best in distilled water or with addition of acetate of lime. Rosenstiehl considers it as nitro-alizarin.

MISCELLANEOUS.

University of London.—The following is the list of the candidates who have passed the recent D.Sc. Examination:—Branch IV. (*Inorganic Chemistry.*)—T. Carnelley, Owens College; F. Clowes, Royal College of Chemistry and private study. Branch VI. (*Electricity, treated Experimentally.*)—J. G. MacGregor, private study. Branch XII. (*Vegetable Physiology.*)—E. B. Aveling, University College. Branch XVI. (*Logic and Moral Philosophy.*)—P. K. Ráy, University and Manchester New Colleges, and University, Edinburgh.

Mineralogical Society of Great Britain and Ireland.—A local meeting of the Cornish members was held at the Public Rooms, Redruth, on Saturday, July 1, when the following papers were read, the chair being taken by Dr. C. Le Neve Foster, Her Majesty's Inspector of Mines for the district:—"On a New Mineral from West Phœnix Mine," by J. H. Collins, F.G.S., with remarks by Dr. C. Le Neve Foster, B.A., &c. This is a hydrous phosphate of alumina and copper, resembling turquoise, but containing much more phosphoric acid and water and less alumina. Mr. Collins has called it Henwoodite, after the late W. Jory Henwood, F.R.S. "On the Occurrence of Pyrophillite at Brookwood, and on New Mineral Localities in Devon and Cornwall," by Dr. C. Le Neve Foster, B.A., &c. "On the Oxide of Iron enclosed in Calcite and Quartz, at the Mwyndy Mines, Glamorganshire," by Wm. Vivian. "On the Occurrence of Pharmacosiderite Scorodite and Olivenite in Greenstone, at Terras Mine, St. Stephens," by J. H. Collins, F.G.S. Mr. B. Kitto, F.G.S., was elected Local Secretary for Cornwall, subject to the approval of the Council.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

An improved continuous horizontal apparatus for washing or absorbing gas or vapours, or for distilling liquids. W. L. Wise, Chandos Chambers, Buckingham Street, Adelphi, Middlesex. (A communication from E. Solvay, Brussels.) March 5, 1875.—No. 820. The apparatus consists in a closed tank or reservoir divided into compartments which communicate one with the other by holes or apertures made in the partitions, the lower holes being for the passage of the liquid, and the upper holes for the passage of the gas or vapour from one end of the apparatus to the other. Over each of the holes for the passage of the liquid into the inner compartments is affixed a tube or pipe bent upwards, and rising vertically to rather above the in ended level of the liquid; and over each of the holes for the passage of gas or vapour into the inner compartments is affixed a gas- or steam-tube or pipe of less diameter than the liquid pipes above referred to, and the said gas- or steam-tubes or pipes extend downwards, and by their lower ends, which are serrated, dip into the liquid pipes respectively, being concentric thereto. The liquid is fed into the apparatus from a separate feed-tank, in which the liquid is kept constantly at the required level by a float and suitable valve. The said liquid passes from the feed-tank into the apparatus, and consecutively through each of the compartments, by passing into each of the liquid pipes, and being projected therefrom by the action of the steam or gas issuing from the steam- or gas-pipes.

Improvements in furnaces for metallurgical operations, which improvements may also be applied to steam-boilers and other furnaces. A. Parkes, Gravelly Hill, Erdington, Warwick. March 6, 1875.—No. 841. This invention consists essentially of a chamber or generator in which gaseous fuel, consisting mainly of carbonic oxide, is generated, the gaseous fuel being conducted over a hollow bridge or hot-air flue into a reverberatory chamber in which copper is smelted, or the puddling of iron, or other like metallurgical operation is carried on. The hot air from this bridge or flue mixing with the gaseous fuel effects its combustion, and produces an intense heat in the reverberatory chamber. The air supplied to the hollow bridge or hot-air flue is heated by passing through the walls of the generator, which are reticulated or honeycombed. The waste heat from the reverberatory chamber may be utilised by being passed to a second or cementing chamber, and from thence to a boiler for the generation of steam. The gas generator and hot-air bridge may be applied to steam boiler and other furnaces unconnected with metallurgical furnaces.

Improvements in the manufacture of "consolidated coal." F. C. Danvers, Argyle Road, Castle Hill, Ealing, and J. H. Landon, Turner Square, Hoxton. March 11, 1875.—No. 897. The novelty of this invention consists of the use of farina or starch in the manufacture of artificial fuel (or consolidated coal) without water, the starch being boiled in tar or other mineral or vegetable oil; also in the melting of the pitch—when that material also is used—in tar, before being mixed with the small of coal, culme, or breeze.

NOTES AND QUERIES.

*** Our Notes and Queries column was opened for the purpose of giving and obtaining information likely to be of use to our readers generally. We cannot undertake to let this column be the means of transmitting merely private information, or such trade notices as should legitimately come in the advertising columns.

Absorbing Power of Charcoal.—Can one of your readers oblige me with a simple method for ascertaining the absorbing power of charcoal samples?—Disinfector.

THE CHEMICAL NEWS.

VOL. XXXIV. No. 868.

ON THE ACTION OF CERTAIN KINDS OF FILTERS ON ORGANIC SUBSTANCES.

PART III.

By J. ALFRED WANKLYN.

A SOLUTION of hydrochlorate of morphia in common London water was prepared by taking 1·320 grms. of hydrochlorate of morphia, dissolving it in water, and diluting the solution to 10 litres. In this manner a solution containing 0·132 grm. of the hydrochlorate per litre of water was obtained. Submitted to the ammonia process this solution was found to yield 2·60 m.grms. of albuminoid ammonia per litre. Five litres of this solution were then allowed to run through the same silicated carbon filter which had been employed for the experiments on quinine described on p. 4, and the 5 litres of filtrate were then thrown away. In this manner the most simple displacement of the liquid occupying the pores of the filter was ensured. About 5 more litres of the solution were next run through the filter, and the filtrate was examined with the following results:—

Milligrammes of albuminoid ammonia per litre of liquid—No. 1, 0·06; No. 2, 0·04. Showing how completely the filtration had removed the morphia from the solution.

As a further corroboration, advantage was taken of the reducing properties possessed by morphia, which decolourised standard solution of permanganate, and which may be titrated with such a solution.

Before submitting it to filtration 100 cubic centimetres of the solution of morphia reduced 8·5 c.c. of decinormal* permanganate solution.

After filtration 100 c.c. of the liquid did not reduce any appreciable quantity of the permanganate. Thus it has been proved that one single filtration through a thickness of 6 inches of "silicated carbon" is sufficient to remove morphia from a solution containing 132 m.grms. of the hydrochlorate of morphia in one litre of water (or 9·24 grains per gallon.)

Having arrived at this result, I next endeavoured to reach the limit of strength capable of being dealt with by these filters. I dissolved 2·739 grms. of hydrochlorate of morphia in 3 litres of distilled water, thereby getting a solution containing 913 m.grms. of that salt per litre of water (or 63·91 grs. per gallon).

This solution, as will be seen, is capable of decolourising decinormal permanganate solution at the rate of 59 c.c. of permanganate per 100 c.c. of the morphia solution.

It was poured on a very small silicated carbon filter; the first half of the filtrate was rejected and the second half examined. The filtrate was at first found to contain much morphia, but after making it pass and re-pass through the filter the morphia was so far reduced in quantity that 100 c.c. of the filtrate decolourised only 2 c.c. of decinormal permanganate, showing that about $\frac{98}{100}$ths of the morphia had been absorbed by the filter. To attain this result, five or six passages through the filter were required.

Until I break up the filter and weigh the fragments of the cake, I cannot say with accuracy how much silicated carbon has been required to absorb the morphia. Roughly, however, the weight of the cake may be set down as 1000 grms, and, at that rate, 1000 grms. of silicated carbon is capable of absorbing at least 2 grms. of hydrochlorate of morphia. I propose, however, to make accurate determinations of the extent to which "silicated carbon" may be loaded with morphia.

I am continuing the experiments, and, in the meantime, I cannot help pointing out how completely my experiments have discredited the dictum that filtration through thick filters can only remove suspended matter.

* This solution contained 0·4 milligramme of active oxygen per cubic centimetre.

A STUDY OF CHLORINE SUBSTITUTION.

By SAMUEL E. PHILLIPS.

IF modern chemistry gained a signal triumph over the great Berzelius in the notable contention, *re* Chloracetic Acid, it would appear that very ignoble results have attended the victory.

Abandoning the untenable ground then taken, it would now appear that hydrocarbons, and their oxy- or other derivatives, subjected to the action of chlorine, evince, among other multiple or additive results, at least two isomeric substitutional changes—one by which the hydride becomes a chloride, leaving the radical untouched; the other by which one H of the radical is replaced by one of Cl.

Hydride of acetyl becomes, in one case, acetyl chloride; in the other, chloracetic hydride—

$$(C_4H_3O_2)H. \quad (C_4H_3O_2)Cl. \quad (C_4H_2ClO_2)H.$$

One necessarily simple and unique, the other would doubtless vary isomerically, as the radical may have a more complex genesis.

Prof. Odling has treated this subject, but not with his accustomed felicity and clear penetration (see *Phil. Magazine*, March, 1876, "On the Formulation of the Paraffins and their Derivatives"):—"By the replacement of one Cl for one H a great variety of paraffins are attainable, as C_3H_7Cl, C_4H_9Cl, &c., the residues constituting the paraffin or alcohol monad radicals, propyl, butyl, amyl, &c.

"But this action gives rise to at least two distinct isomers, and a study of their formative and transformative reactions leads to the conclusion that the difference between them depends upon whether they result from a substitution of the introduced radical for the H of a methyl, or of a methylen residue; the paraffin radicals resulting in this way from the introduction of a foreign radical in the place of H, &c., affording the means for their classification. Thus:—

Butane.	Butyl (primary).	Pseudo-butyl (secondary)
$H_2C\begin{cases}C_2H_5\\CH_3\end{cases}$	$H_2C\begin{cases}C_2H_4Cl\\CH_3\end{cases}$	$ClHCl\begin{cases}C_2H_5\\CH_3\end{cases}$

Iso-butane.	Iso-butyl.	Kata-butyl tertiary
$HC\begin{cases}CH_3\\CH_3\\CH_3\end{cases}$	$HC\begin{cases}CH_2Cl\\CH_3\\CH_3\end{cases}$	$ClC\begin{cases}CH_3\\CH_3\\CH_3\end{cases}$

Whether residues are synonymous with radicals, and whether both are tri-, di-, mono-, or anhydric, and also tri-, di-, and mono-atomic, does not clearly appear from the context.

How purely visionary or hypothetic these fundamental conceptions are does not appear to have disturbed the Professor at all. An alcohol may be considered a water derivative—

$$\left.\begin{matrix}C_3H_7\\H\end{matrix}\right\}O$$

or a paraffin derivative—

$$H_2C\begin{cases}CH_2.OH,\\CH_3\end{cases}$$

but these condensed forms are very optional, and must be referred to their fundamental basis.

Pentane, for instance, may be considered a propyl-methyl-methane—

$$H_2C\begin{cases}C_3H_7\\CH_3\end{cases}$$

or a butyl-methane, $H_3C.C_4H_9$, or propyl-ethane, $H_3C_2.C_3H_7$, or diethyl-methane—

$$H_2C\begin{cases}C_2H_5\\C_2H_5\end{cases}$$

or dimethyl-propane—

$$H_6C_3\begin{cases}CH_3\\CH_3\end{cases}$$

and as far as the nature of the paraffin is concerned one is as correct as the other; but they are all condensed expressions of the one true formula—

$$H_3C.H_2C.H_2C.H_2C.CH_3.$$

We stay not to discuss such elements of difficulty and hypothesis, but we do ask, What is the outcome thereof in the region of practical manipulation?

The most simple and fertile distinctions, appreciable even to the amateur mind, are wholly ignored, while learned Professors are discussing methylen dispositions and polyatomic peculiarities worthy of mediæval metaphysics.

That Prof. Odling is amiably and earnestly desirous to extend our knowledge of isomerism no one will doubt; but, standing before his methylen basis of terminology and classification, there are simpler matters, more within reach, which demand a juster and clearer appreciation.

When chloro or nitro substitutions subsist isomerically, the A B C of the matter is to determine where the chlorine or other radical has alighted, "whether in a methyl or in a methylen residue," &c.

Per contra, we hold that in such cases, whenever two or three isomers subsist, as a general rule, the isomeric differences are due to the radical itself, and equally subsist when the Cl or (NO_4) is withdrawn; and that the A B C of the matter is to distinguish between a chloride and a chloro-radical; and, further, that this distinction is a real one in fact, as well as a primary one in chemical ethics, extending also to the H of the hydride.

Some chemists take great pains to insist that in methane no difference is appreciable among the H elements; but, taking methane and mellissane as extremes, may we not fairly ask for some appreciation of the volumetric and other differences due to the H elements?

This may not be capable as yet of absolute demonstration, and there may be difficulty in isolating the radicals without dedoublement or condensation; but the hypothesis is deserving of respect and further research, that the 61 H elements of melissyl are condensed into one volume; and that the added one H of the hydride or chloride doubles the entire volume.

If chemists can distinguish between the atomic volumes (solid) of O = 12·2 in acetyl, and O = 7·8 in alcohol, surely they may be able to appreciate the difference between H in methyl or mellissyl and the H of their hydrides, seeing that one is, perhaps, one hundredfold more condensed than the other.

And similarly with the chlorine of chloracetyl, as compared with that of acetyl chloride.

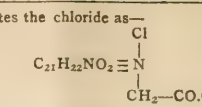
Whether we have ammonia, trimethyl ammonia, or tristearyl ammonia, who is there that doubts that these condensations do really represent so many H equivalents, both chemically and volumetrically; and whether this hypothesis in all its bearings will pierce the clouds of prejudice, and ripen into true theory is not at all the present question, which is rather as to what advantages have accrued from a studied disregard of the plainest facts, and in illustration thereof we confine a few remarks to chloracetic acid.

At the outset, we may assume for the elements so-called at least two isomeric forms:—

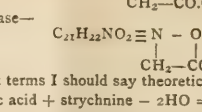
The true chloracetic acid, $(C_4H_2ClO_2)O.HO = C_4H_3O_4Cl$,
glycolyl chloride, $(C_4H_3O_4)Cl = C_4H_3O_4Cl$.

Dr. P. Romer digested a mixture of mono-chloracetic acid with strychnine at 180° C. for several hours, and obtained a new base: that he combined with platinic chloride, giving the salt $C_{23}H_{24}O_4NHCl.PtCl_2$.

He notates the chloride as—



The free base—



In simplest terms I should say theoretically—

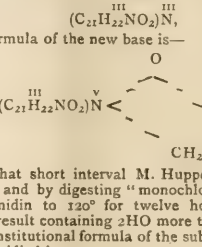
Glycollic acid + strychnine − 2HO = the new base.

A few weeks before this M. Strecker had discovered the same result with fuller particulars, calling the new base "Glycol-strychnine," which it is not (CHEMICAL NEWS, vol. xxiv., p. 263).

"Taking the constitutional formula of strychnine as—

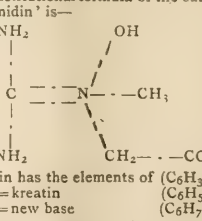
$$(C_{21}H_{22}NO_2)^{III}N,$$

then the formula of the new base is—



Within that short interval M. Huppert falls into the same error, and by digesting "monochloracetic acid with methyl-guanidin to 120° for twelve hours," obtains a crystalline result containing 2HO more than kreatin.

"The constitutional formula of the substance 'glycolyl-methyl-guanidin' is—



Kreatinin has the elements of $(C_6H_3O_2)CyH_4N_3$
+ 2HO = kreatin $(C_6H_5O_4)CyH_4N_3$
+ 2HO = new base $(C_6H_7O_6)CyH_4N_3$.

By the reaction of "monochloracetic acid" upon morphia the author obtained a crystalline base belonging to the same class of bodies.

Methalcohol + morphia − 2HO =

$$\left.\begin{matrix}C_{34}H_{18}O_6\\C_2\ H_3\end{matrix}\right\}\ C_{36}H_{21}O_6N,\ \text{CODEIA}$$

Acetic acid, monochloracetic acid, or acetic chloride } + morphia − 2HO =

$$\left.\begin{matrix}C_{34}H_{18}O_6\\C_4\ H_3\ O_2\end{matrix}\right\}\ C_{38}H_{21}O_8N,\ \text{acetyl morphia}$$

Glycollic acid or glycolyl chloride } + morphia − 2HO =

$$\left.\begin{matrix}C_{34}H_{18}O_6\\C_4\ H_3\ O_4\end{matrix}\right\}\ C_{38}H_{21}O_{10}N,\ \text{glycolyl morphia}$$

In the reactions with true chloracetic acid there is a tendency to elimination of the Cl to a normal acetyl substitution, but this is not always the case, as with chloracetyl urea, and many others,—

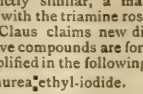
$$(CO)_2(C_4H_2ClO_2)H_4N_2,\ \&c.$$

M. Claus similarly trips in a recent study of sulphurea combinations.

Urea "hydrochloride,"	$(CO)_2H_4N_2HCl$
Sulphurea with ethyl iodide,	$(CS)_2H_4N_2EI$
" " acetyl chloride,	$(CS)_2H_4N_2(C_4H_3O_2)Cl$
" " monochloracetic acid,	$(CS)_2H_4N_2(C_4H_3O_4)Cl$

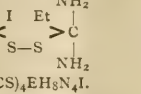
Now who does not see that these are indeed very normal and old fashioned combinations, since ammonia with ethyl iodide behaves strictly similar, a matter so well exemplified by Hofmann with the triamine rosaniline salts. Yet, strange to say, M. Claus claims new discovery, and he believes "these additive compounds are formed through the S molecules, as exemplified in the following formulæ:—

Disulphurea ethyl-iodide.



$= (CS)_4EH_8N_4I.$

Sulphurea ethyl-iodide.



$= (CS)_2EH_4N_2I.$

We have enlarged elsewhere on the same want of discrimination in respect of Armstrong's invaluable epitome of the science (see Chemical News, vol. xxxii., p. 2), and could give many other illustrations, but in utmost brevity we conclude with a recent discovery of "melid acetic acid." The others are curious, but this one is much more so, and the determination to make it an "acetic acid," involves an invasive audacity, which is as marvellous as it is racy. The idea is that one H of acetic acid is replaced by the radical or base "melamid;" but what is melamid?

Thanks to Hofmann we know pretty clearly what melamine is, both as a free base and as evinced in saltic types. Melamid, then, is said to be "melamine – H_2."

Now this feature may be very nice for a "residue," but it is very damnatory for a radical or base, having a mono equivalence; and it irresistibly tempts us to turn the whole thing upside down, when, lo! the result is no acid at all, but a "*glycolyl*-melamine," behaving chemically and typically as a substituted melamine, and acetic acid probably has no existence, either before or after the reaction.

Melamine, $C_3H_6N_6$	– $Cy_3H_6N_3$
Melid acetic acid or glycolyl melamine, $C_3H_5N_6.CH_2.COOH$	$Cy_3H_5GN_3$ $G=(C_4H_3O_4)$
The hydrochloride,	$Cy_3H_5GN_3HCl$
The nitrate,	$Cy_3H_5GN_3HO.NO_5$
The sulphate,	$Cy_3H_5GN_3HO.SO_3$
The platinate,	$Cy_3H_5GN_3HCl.PtCl_2$
	&c.

The sulphate or nitrate of a melid acid looks very much like a *melée* of confusion, whereas melamine gives mono salts exactly like those above.

Truly chemists stick at nothing in order to carry out their preconceptions, and in sight of such results one is tempted to ask *Cui bono?*

It may be urged that, admitting an acetyl body most normally gives an acetyl substitution, yet that exceptional cases of oxidation may transform that radical into glycocol (or oxacetyl). And some may further contend that the above *bizarre* types are models of atomic penetration and artistic ingenuity derived from a study of the formative and transformative reactions involved.

They are nothing of the kind; they are fanciful pleasantries, the legitimate offspring of fanciful hypothesis; and against this torrent of passing fashion I can do nothing but protest, and, with one leg in the grave, I can hopefully retire with the certain conviction that truth will be paramount, and that a better time is coming, when science will be more popularised, and simplicity of conception will no longer be tabooed as necessarily superficial knowledge.

The people may have much to learn, but the professors have much to unlearn. A wide demand for the bread of truth is increasing, and the people will not be satisfied with the pedantic stones of learned hypothesis.

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 5.)

Chlorine, Bromine, Iodine, and Fluorine.
By Dr. E. Mylius, of Ludwigshafen.

For many purposes, especially in the manufacture of sugar, there is required a hydrochloric acid free from sulphuric acid, iron, and arsenic. Very various proposals have therefore been made for obtaining a pure acid from the arseniferous product. Thus, Houzeau,† in order to obtain the acid free from arsenic distils the crude acid, adding 0·3 grm. pulverised chromate of potash to 3 litres, and, in order to protect the arsenic acid produced by the liberated chlorine from the reducing action of the hydrochloric acid, he causes during the distillation a continued stream of a solution of chromate of potash of tenfold the strength to be added. The escaping hydrochloric acid gas is freed from the accompanying chlorine by means of copper turnings and is then conducted into water. This process, however, is scarcely applicable on the large scale, as chlorine is necessarily evolved in very considerable quantities, and its absorption by means of copper is somewhat costly. P. W. Hofmann,‡ of Dieuze, on the other hand, has successfully introduced the following method for purifying hydrochloric acid:—A vessel with a doubly perforated earthenware stopper is filled with hydrochoric acid to the extent of one-third, and sulphuric acid of sp. gr. 1·848 is introduced by means of a funnel capable of being closed. The hydrochloric acid gas, which is given off very regularly, is washed in a Woolff's bottle and absorbed by distilled water in a receiver.

The evolution of gas ceases as soon as the sulphuric acid has fallen to the sp. gr. 1·566, in which case it only retains 0·32 per cent of hydrochloric acid. The sulphuric acid thus diluted is either employed direct in the manufacture of sulphate of soda, or it is re-concentrated, the expense of which amounts to 1 franc per 100 kilos. As 100 kilos. of sulphuric acid thus yield 40 kilos. hydrochloric acid of sp. gr. 1·181, 100 kilos. of pure hydrochloric acid prepared by this process are 2½ francs dearer than the crude acid. Fresenius,‖ however, remarks that the acid thus purified is not quite free from arsenic, the gas evolved containing arsenic at every stage.

Bettendorf§ prepares pure hydrochloric acid by utilising the fact that arsenious acid in a concentrated hydrochloric solution is thrown down by protochloride of tin as a brown precipitate composed of arsenic with 1·5 to 4 per cent of tin. He mixes the concentrated acid with a concentrated solution of stannous chloride, filters off the precipitate, and distils, thus obtaining an acid perfectly free from arsenic.

This is confirmed by Mayrhofer,¶ but Hager** adds that if all the arsenic is not removed by filtration the distillate again becomes arseniferous. Dietz treats the hydrochloric acid with sulphuretted hydrogen, whilst

* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzehends."
† Houzeau, *Compt. Rend.*, lix, 1025. *Wagner, Jahresber.*, 1865, 253.
‡ P. W. Hofmann, *Ber. Chem. Ges.*, 1869, 272.
‖ *Journ. Analyt. Chemie*, 1870, 64.
§ Bettendorf, *Dingl. Pol. Journ.*, cxciv., 253. *Wagner, Jahresber.*, 1869, 219.
¶ Mayrhofer, *Ann. Chem. Pharmacie*, clviii. 236.
** Hager, *Wagner Jahresber.*, 1872, 262.

Engel employs hyposulphite of potassium for the same purpose. Of all these processes that of P. W. Hofmann is probably the only one used on a large scale. The pure hydrochloric acid required in the sugar manufacture is chiefly prepared in certain small establishments which make their sulphuric acid from sulphur, or which have at command non-arseniferous pyrites, *e.g.*, at Saarau, in Silesia.

(To be continued.)

REDUCING ACTION OF PHOSPHINE.

Phosphine (PH_3) exerts a powerful reducing action upon sulphuric acid (SO_2HO_2). When passed into the strong acid the gas is absorbed rapidly at first, without any visible change, but when the acid has become saturated, and the action of the gas is still continued, the acid rapidly becomes heated sufficiently to ignite the phosphine. If the sulphuret be kept cool by a stream of water and the gas passed into it in excess, reduction to sulphurous anhydride, SO_2, with separation of sulphur takes place.

The action may be thus represented—

$$3(H_2SO_4)+2PH_3=2SO_2+S+2(H_3PO_4)+3H_2.$$

Hydric sulphide may be produced, but, if so, is decomposed immediately by the SO_2.

If the action be continued sufficiently long, the acid being kept cool, it becomes so thick and viscid with the separated sulphur that the vessel may be inverted without its contents escaping.

W. R. H.

Royal College of Chemistry,
South Kensington, July, 1876.

THE EFFECT OF FLEXIBILITY ON THE WORKING OF CHEMICAL BALANCES.*

By B. S. Proctor.

Having expressed the opinion that the degree to which a balance beam bends under its load forms an element too important to be overlooked in any satisfactory theory of its sensitiveness, I made an examination of several beams, good and bad, that I might first ascertain the degree to which bending takes place, and then calculate the effect which that bending would have upon the turning of the beam.

I did not propose that my experiments should have any special accuracy, such as would be required in critical examination of the relative merits of two similar beams, but only that they should be trustworthy, as shewing that flexibility has an influence—an influence greatly to the disadvantage of badly-designed beams, and not entirely to be overlooked in those of ordinary construction, but which almost vanishes in the beam in which Mr. Bunge has combined the advantages of superior mechanical principles with unusually good material and excellent workmanship.

I commenced with a beam of no value—a common dispenser's box-end beam, made of brass, its length between terminal bearings being 6·7 inches and its weight 680 grs. I bound it down against the edge of a strong steel bar—a file, in fact—the box-ends forming the terminal supports of the beam, while the pressure was applied to the centre, and the bending estimated by the diminution of the distance between the centre of the beam and the bar. This movement was necessarily very small, and the value of the observations must depend upon the extent of this small movement being fairly estimated. After a few preliminary attempts the method I adopted was to cement a slip of glass upon the bar projecting beyond its edge towards the beam, and a piece of mica upon the beam projecting over the edge of the glass; the movement of the edge of the mica over the edge of the glass was observed by a microscope magnifying several hundred diameters, and measured on an ordinary scale of inches and fractions laid upon the microscope stage, and observed with the left eye, while the mica was observed with the right eye through the microscope.

The pressure representing the load was applied by means of a spring, as the observations were most conveniently made with the movements in the horizontal plane. The spring used was a pair of microscope pliers having a distance of half an inch between their points, and it was found by experiment that each one-sixteenth of an inch compression represented a pressure equal to nearly 500 grs.—sufficiently near for my purposes. This spring was held in place by pins in the board which carried the whole arrangement. I placed one end of the spring just in contact with the middle of the beam, while the other was free to receive pressure, the pressure being regulated by fixing a pin in the line of motion of the free end and at such a distance as limited the compression of the spring to the degree which was required to produce the pressure desired. When the pressure was 500 grs., that is, equal to 250 grs. in each pan, the flexure equalled $\frac{1}{800}$ of an inch, and with four times the pressure the movement was $\frac{4}{800}$ inch, thus confirming the first observation. The observations were repeated many times, with only such differences in the measurements as would naturally result from the nature of the experiment.

The second beam operated upon was a German dispensing beam of better quality than the above. Being of a different shape, it was found more convenient to fix one end and the middle, and apply the pressure to the free end of the beam, using the spring in the same manner as before, but adopting a new arrangement for microscopic observation. A microscope slide cemented to the end of the bar had diamond scratches upon its upper surface; a similar slip laid upon it with diamond scratches upon its under surface; the end of the beam rested upon this upper slip of glass, and was made to adhere to it with cement. The diamond lines being on contiguous surfaces of glass were readily brought into a sufficiently good focus for work, but a lower power was necessary in consequence of the thickness of the glass through which the observation had to be made. A magnifying power of 125 linear was, however, readily applied and found quite sufficient for the purpose. A drop of oil interposed between the glass slips rendered the focusing more satisfactory, but the motion rather less free. When the pressure equalled 500 grs. in each pan, the bending thus observed equalled 1·1000th inch, and when the pressure equalled 2000 grs. in each pan, the bending was $\frac{4}{1000}$ inch. These flexures must be halved to compare them with those of the first beam.

The third beam examined was one of Oertling's, intended to carry 1000 grs. on each pan, and turn with $\frac{1}{10}$ of a gr. The examination was conducted in the same manner as the last. The bending with the equivalent of 1000 grs. in each pan was $\frac{1}{1250}$ inch, which observation, after being several times repeated, was further confirmed by doubling the pressure and finding that the flexure was also doubled.

Finally, Bunge's beam was examined in the same manner; being designed to carry 3000 grs. in each pan, and turn with $\frac{1}{10000}$ gr. it was not to be expected that flexure should be observed to a measurable extent with light pressures. I found them too small to be satisfactorily estimated with pressures less than 2000 grs. in each pan; under this load the bending was $\frac{1}{5000}$ inch.

The following table shows the above results in a convenient form for comparison. The beams are arranged in the order in which they were examined. Their order also coincides with the development of the mechanical principles upon which they have been designed, and indicates progressive improvement in their working qualities, the second being both longer and lighter, yet less flexible than

* Read before the Newcastle-upon-Tyne Chemical Society.

the first, as a consequence of the better distribution of its mass; so in comparing Bunge's beam with Oertling's we have both the weight and flexibility reduced to less than one-third, and the figures might have been still more in favour of Bunge's had it been practicable to make an equal reduction in weight upon those parts of the beam upon which there is little mechanical strain, but as in these parts there is not much excess in the old beams, there is not the same scope for reduction.

	Length of Radius	Weight of Beam	Bending Moment of one grain under 100 gr. at each End	Fall in Centre of Gravity of Load.
Dispensing beam ..	6·7	680	0·00222	0·00111
Do. better quality ..	8·3	635	0·00200	0·00100
Oertling's balance ..	12·0	1786	0·00083	0·00041
Bunge's ,, ..	5·0	616	0·00025	0·00012

In endeavouring to calculate the influence which the bending (as estimated by the preceding experiments) has upon the sensitiveness of the beam, I have not attempted to follow the Algebraic method as expounded by Prof. Aldis, but have contented myself with the methods of plane geometry and arithmetic with which I am more familiar, but which appear to me to tend to precisely the same conclusions.

If we take C as the centre of a circle, A B and E D its diameters, F D also representing a beam of which C B is the pointer, two or three simple propositions will enable us to calculate the sensitiveness of the beam and the effect that bending has upon it. Let the lines A H, H B, and H I, be drawn, the latter being perpendicular to C B. I B will have the same ratio to H B that H I has to A H. Wherever the point H may be placed, these ratios remain the same. Now, let C H be the pointer deflected by a weight added to the beam at D, and having swayed the beam to the position F G, the weight and the distance taken together represents a certain mechanical power. If it be a foot-pound, and the beam has come to rest at F, then the work performed by this power must be a foot-pound also. Foot-pounds being too large for present use, inch grains or inch m.grms., will be more convenient.

If, now, be suppose C to be the fulcrum, and the centre of gravity of the beam, $\frac{1}{1000}$ gr. added to D and x gr. added to B, the length of the beam being 10 inches, the fall of D being $\frac{1}{10}$ inch, the deflection at B will also be $\frac{1}{10}$ inch—the fall of $\frac{1}{1000}$ gr. $\frac{1}{10}$ inch = $\frac{1}{10000}$ of an inch gr. The deflection at B being $\frac{1}{10}$ inch, is $\frac{1}{100}$ of the length A B, and for practical purposes at these small deflections also $\frac{1}{11}$ of the length of A H. Now, as I B bears the same ratio to this $\frac{1}{11}$ as this $\frac{1}{10}$ inch bears to A B (10 inches), the weight added to B has been raised vertically $\frac{1}{110}$ of $\frac{1}{10}$ of an inch, or $\frac{1}{1100}$, and as this work done equals $\frac{1}{10000}$ of an inch gr., so x gr. must be the weight so raised. Now, suppose the beam to weigh 1000 grs., and that no weight had been added to B, while the same deflection of the pointer had taken place and the same work consequently had been performed, the centre of gravity of the beam must have been raised by the turning just so much as to equal $\frac{1}{1100}$ of an inch gr., and that this may take place the centre of gravity must be as many times nearer the fulcrum as the weight of the beam is greater than that previously supposed to be acting at B. As its weight is 10,000 times greater, its distance will be $\frac{1}{10000}$ of C B (5 inches), or 0·002 inch. If it be admitted that the distance between the centre of gravity of the beam and the fulcrum must be so small under these circumstances, and smaller still when the beam is heavier of the same length, the amount of bending which I have obtained is sufficient to interfere with its sensibility; and the difference in flexibility between Bunge's beam and the forms at present in use in the laboratories, is sufficient to give Bunge's a distinct superiority in this respect.

In estimating the effect of the bending of the beam, it must be remembered that the centre of gravity of the beam does not fall to the same extent as the bending takes place, but only to a smaller extent, and an extent which it is not practicable to estimate; but the virtual centre of gravity of the *load* falls *to the full extent of the bending*.

In the above illustration, that of a beam weighing 1000 grs. with its centre of gravity 0·0005 below its fulcrum, and its end bearings on a line with its fulcrum when not strained, if we suppose a bending to take place when loaded such as takes place in the Oertling beam examined, then the resistance is increased from 1000 × 0·0005 to this product, + 2000 × 0·0004 that is, the weight of the pans with their load multiplied by the fall which has taken place in their centre of gravity, leaving out of the question the falling in the centre of gravity of the beam due to its bending. Thus the resistance due to bending would bear to the original resistance the ratio of 8 to 5.

Supposing the pointer of the Oertling beam to move 0·1 inch with $\frac{1}{2000}$ gr., I calculate the centre of gravity to be 0·00027 below the fulcrum, and its resistance to the supposed movement would be thus multiplied by its weight 1786 grs. and the additional resistance due to bending would be 2000 × 0·00041. By this calculation the resistance due to bending is to the original resistance as 82 to 48.

Supposing the pointer of Bunge's beam to move 1 m.m. with 0·1 m.grm., I calculate the centre of gravity to be 0·00304 inch below the fulcrum, and its resistance consequently 600 × 0·00304; while 1000 grs. in each pan = 2000 × 0·00012 (the extent of its bending), gives the additional resistance consequent upon its bending under its load. The resistance due to bending is to the original resistance as 24 to 182.*

Since the distance between the fulcrum and the centre of gravity may be indefinitely decreased, the sensitiveness of the beam may be indefinitely increased provided the mechanical defects of the beam do not stand in the way, but length and its consequence—either considerable weight or palpable flexibility—are prominent obstacles to this mode of increase of sensibility, and the palpable thickness of the knife edges is another obstacle. In the ordinary steel knife edges, however fine they may be at

* In a balance recently designed by Prof. Mendeleef, the length of the beam is rather less than Bunge's, and it is stated to turn with 1/1000 gr. when loaded with 15,000 grs. I have not seen this balance, nor even a detailed description of it; such particulars as I have are quoted from the *Pharmaceutical Journal* of March 11, 1876. Mendeleef accomplishes this extreme sensibility by adding micrometer scales and cross threads at the ends of the beam, and a telescope for their observation—a refinement which was introduced by Prof. W. H. Miller, and which, while it greatly increases the delicacy of the observation, removes it beyond the sphere of ordinary daily appliances. I had not seen any notice of Mendeleef's balance till after I had drafted my present communication.

first, they can scarcely be brought with pressure upon the agate planes without a palpable thickness being imparted to them.* Those I have examined had a thickness visible to the naked eye, while Bunge's, made of quartz crystal, I have not succeeded in seeing with the aid of a lens. I must admit that a fine edge would be much less readily seen in a material like crystal than in metal, but it must also be admitted that the greater hardness of the stone would give a permanence to the edge which a steel edge would not possess. Suppose we admit that in the crystal edges and planes the imperfections of a fulcrum are as nearly as possible eliminated—that the flexibility has been reduced to its smallest practical amount by the use of the girder form adopted by Bunge—that the sensitiveness is under our command by screwing up the centre of gravity, and that the quickness has been obtained by reducing the length of the beam, where lies the practical limit to the smallness of the weight which will turn the beam? Mathematics would teach us that any weight, however small, would turn the beam to *some* extent, and that the limit is the limit of our vision. This points to the last particular in which Mr. Bunge has improved upon the old models. Having secured movement by the means already pointed out, he has magnified the motion by increasing the length of his pointer, and this is of more importance than would at first sight appear, for it gives the principal advantages of a long beam without its failings, for the long pointer adds very little to the slowness of turning, and nothing to the flexibility.

In making these remarks I would not have it supposed that I am writing up the performances of Bunge's balance. I have simply endeavoured to understand and to explain by what principles the maker has obtained the very excellent results which we all admit.

I must also add, that while I have connected Oertling's name with a balance not equal to Bunge's, I do not imply that Oertling's workmanship is inferior; on the contrary, requiring for the sake of comparison to experiment upon a beam of the form in general use, I preferred to take one of Oertling's on the ground that his name was a guarantee of good quality.

A NEW METHOD FOR THE DETECTION OF COPPER, CADMIUM, AND BISMUTH.†

By MALVERN W. ILES, Ph.B,
School of Mines, Columbia College.

In working upon the cyanogen compounds, the experimenter knows not what singular and unexpected results he may bring about at every step. That his results are often very highly characteristic is well proven by the beautiful shades of blue, green, red, white, yellow, and brown produced from this radical. Some of these tints are, however, very far from being beautiful; thus we have a dirty, dark yellowish brown. Other shades may be described as brownish yellow, reddish brown, brownish grey, deep reddish brown, yellowish brown, orange-yellow, and various shades of white.

The deportment of various reagents with the cyanogen compounds may give rise to products entirely nullifying the experimenter's theoretical considerations, but frequently very highly characteristic of the element with which he is experimenting.

As an illustration of the singular changes which cyanogen compounds undergo, I may cite the following:—

An aqueous solution of cyanogen rapidly decomposes, yielding ammonium oxalate, paracyanogen, a brown insoluble matter, and other products.

Hydrocyanic acid can scarcely be preserved alone, even when enclosed in a carefully stopped bottle; it soon darkens, depositing a black substance containing carbon, nitrogen, and perhaps hydrogen: ammonia is formed at the same time, and many other products. Light favours this decomposition. Dilute solutions soon become turbid, but not always with the same degree of rapidity, some samples resisting change for a great length of time, and then suddenly solidifying to a brown pasty mass.

When hydrocyanic acid is mixed with concentrated mineral acids, as hydrochloric, the whole solidifies to a crystalline paste of ammonium chloride and hydrated formic acid.

On the other hand, when dry ammonium formate is heated to 392° F., it is almost entirely converted into hydrocyanic acid and water.

The experimenter may also produce, at any step, cyanides, cyanates; cyanic and cyanuric acids; hydrated cyanic acid, hydro-ferro and hydro-ferricyanic acids, or the combination of the same with bases. I might further cite as an illustration of these remarkable changes, that cyanic acid when mixed with water is decomposed almost immediately into acid carbonate of ammonium; that pure cyanic acid on standing soon changes spontaneously, with a sudden elevation of temperature, into a solid, white, opaque, amorphous substance, called cyamelide. Furthermore, this curious body has the same composition as cyanic acid, but is insoluble in water, alcohol, ether, and dilute acids; it is soluble in strong oil of vitriol by aid of heat, with the evolution of carbonic acid and the production of ammonia. When boiled with a solution of caustic alkali it dissolves with the disengagement of ammonia, and a mixture of cyanate and cyanurate of the base generated. By dry distillation cyamelide is again converted into cyanic acid.

The artificial production of urea, a product of the human body, from ammonium cyanate, marked a new era in organic chemistry, and constitutes one of Wöhler's greatest discoveries.

Urea is decomposed, by the aid of heat, into cyanuric acid and ammonia. Cyanuric acid is changed by a very high temperature into cyanic acid. The study of cyanic and cyanuric ethers, which were discovered by Wurtz, has led to very important and curious results.

In this connection may be mentioned that curious body, fulminic acid, which is isomeric with cyanic and cyanuric acids; also fulminuric acid, isomeric with cyanic, fulminic, and cyanuric acids. In short, cyanogen and its compounds are to me a perfect marvel! It is, I think, one of the main keys to the intricate secrets of Nature, and when its behaviour is properly understood will unlock the door to various phenomena in organic chemistry now inexplicable.

While working upon the ferro- and ferri-cyanides of nickel and cobalt, with reference to a qualitative detection of nickel in the presence of cobalt, I was led to study the reactions of various other metals with the reagents above mentioned. Some of these reactions were so striking that a qualitative separation immediately suggested itself. For example, a solution of potassium ferricyanide (1 part salt to 38 parts water) yields with copper a dirty yellowish brown precipitate, with bismuth a yellowish brown, and with cadmium a light yellow precipitate. The copper and cadmium ferricyanides were found to dissolve entirely in potassium cyanide in slight excess, while the bismuth separated in white floccules. Using this fact as a basis, my mode of procedure may be briefly stated as follows:—Proceed with the H_2S group up to the point where Cu, Cd, and Bi are obtained in solution together, as usual, care being taken not to have too large an excess of free acid; then proceed with the following scheme:—

Scheme for Cu, Cd, *and* Bi.

Add $6KCyFe_2Cy_6$ to slight excess; next add KCy and gently warm—the Cu and Cd are dissolved, while the Bi remains as a hydrate; filter.

* Mendeleef says in the ordinary arrangement of steel knife edges upon agate bearings the wearing not only damages the stability of the balance but also quickly destroys its sensibility.

† A Paper read before the Chemical Section of the New York Academy of Sciences.—*American Chemist.*

Residue.	Filtrate. Contains Cu and Cd; divide into equal parts.	
	Solution A.	*Solution B.*
White flocculent ppt. = $Bi_2(HO)_6$. Confirm on charcoal by use of the "Bismuth Flux" (KI+S).	Add a few drops of $(NH_4)HO$, then $(NH_4)_2S$ and gently warm; a yellow ppt. = CdS.	Add HCl(dil) to strong acid reaction; a reddish ppt. = Cu_2FeCy_6.
Bi.	Cd.	Cu.

The basis of the above scheme may be stated as follows :—

1. The complete precipitation of copper, cadmium, and bismuth by potassium ferricyanide.
2. The solubility of copper and cadmium ferricyanides in potassium cyanide.
3. The decomposition of bismuth ferricyanide into bismuthic hydroxide by the action of potassium cyanide.
4. The insolubility of cadmium sulphide and the solubility of cupric sulphide in potassium cyanide.
5. The insolubility of copper ferrocyanide and the solubility of cadmium ferrocyanide in hydrochloric acid.

The Chemical Reactions.

(*a*). $6KCy.Fe_2Cy_6 + Bi_2(NO_3)_6 = \underbrace{Bi_2Fe_2Cy_{12}}_{\text{White.}} + 6KNO_3.$

(*b*). $6KCy.Fe_2Cy_6 + 3Cu(NO_3)_2 = \underbrace{Cu_3Fe_2Cy_{12}}_{\text{Yellowish white.}} + 6KNO_3.$

(*c*). $6KCy.Fe_2Cy_6 + 3Cd(NO_3)_2 = \underbrace{Cd_3Fe_2Cy_{12}}_{\text{White.}} + 6KNO_3.$

(*d*). $Bi_2Fe_2Cy_{12} + 8KCy + 6H_2O = 2Bi(HO)_3 + 2(4KCy.FeCy_2) + \overbrace{6HCy} + \overbrace{Cy_2}.$

(*e*). $Cu_3Fe_2Cy_{12} + 14KCy = 3[(KCy)_2.CuCy_2] + 2(4KCy.FeCy_2) + \overbrace{Cy_2}.$

(*f*). $Cd_3Fe_2Cy_{12} + 14KCy = 3[(KCy)_2.CdCy_2] + 2(4KCy.FeCy_2) + \overbrace{Cy_2}.$

(*g*). $(KCy)_2.CuCy_2 + 4HCl = CuCl_2 + 2KCl + 4HCy.$

(*h*). $2CuCl_2 + 4KCy.FeCy_2 = \underbrace{Cu_2FeCy_6}_{\text{Cu}} + 4KCl.$

(*i*). $CuS + 4KCy = (KCy)_2.CuCy_2 + K_2S.$

(*j*). $(KCy)_2.CdCy_2 + (NH_4)_2S = CdS + \overbrace{\text{[} (KCy)_2(NH_4)_2Cy_2 \text{]}}$

(*k*). $\text{[} (KCy)_2(NH_4)_2Cy_2 \text{]} = 2K(NH_4)Cy_2$ or $\text{[} 2KCy - 3(NH_4)Cy_2 \text{]}$

I proved by experiment that when copper, cadmium, and bismuth ferricyanides are treated with an excess of KCy, potassium ferrocyanide is formed (see Equations *d*, *e*, and *f*).

It is difficult to say whether Equations *g* and *h* represent the exact chemical change that takes place, since there is a discussion in regard to the compound called "Hatchett's Brown" or copper ferrocyanide. Reindel gives its composition as $Cu_3K_2FeCy_{12}$ (see *J. Pr. Chem.*, ciii., 166), while this formula is called in question by Wyrouboff, who gives the formula Cu_2FeCy_6, probably with 6 mol. H_2O (see *Bull. Soc. Chim.* [2], xii., 98; xiv., 145).

The qualitative reactions for cadmium and bismuth have always been a source of annoyance, and the valuable aid of the blowpipe has almost invariably been used by the chemist to decide the presence of these elements. While recognising the delicacy of the blowpipe methods for the detection of copper, cadmium, and bismuth, and the blowpipe as a most useful auxiliary in qualitative work, I think the chemists will bear me out in the statement that the *test-tube*, and not *charcoal*, is the proper place for the detection of substances in a qualitative laboratory, and that the blowpipe methods should only be used as a confirmatory test. In order to illustrate this point I will state that, were entire reliance placed in the "bismuth flux" for the detection of bismuth, errors might arise; for example, mercury and antimony—both members of the H_2S group—give, under certain conditions, a red coat with the "bismuth flux" (4 parts S +1 part KI).

By taking powdered stibnite (Sb_2S_3) and mixing it with 50 to 60 per cent sulphur, I succeeded several times in obtaining a very fine red coat, closely resembling the bismuth coat.

The objections to my scheme, so far as I have been able to find out, are, that students do not seem to think there is much difference between "gently warm," as I term it in the scheme, and to *boil hard* for about half-an-hour, thus causing a decomposition of the cyanogen compound and a deep blue colour. The second objection is the evolution of cyanogen and hydrocyanic acid.

Although I have not applied this method in quantitative separations of copper, cadmium, and bismuth, yet I see no reason why it should not be a good one, especially for cadmium and bismuth.

The excellent method of precipitation of copper by use of the battery seems to leave nothing to be desired in this direction.

Fresenius gives four methods in which bismuth may be weighed, placing the teroxide first on the list. He says the method gives accurate results, though generally a trifle too low, owing to the circumstance that bismuth carbonate is not absolutely insoluble in ammonium carbonate.

He also adds, "Were you to attempt to precipitate bismuth by means of ammonium carbonate from solutions containing sulphuric acid or hydrochloric acid, you would obtain incorrect results." Every author I have consulted says $Bi_2(HO)_6$ is insoluble in KCy: it seems, therefore, highly probable that the decomposition of bismuth ferricyanide by KCy into $Bi_2(HO)_6$ may be used as a quantitative method for the estimation of this metal. Furthermore, the presence of both hydrochloric acid and sulphuric acid does not seem to interfere with the complete separation of the hydroxide.

I have quite recently noticed that if an excess of potassium cyanide is not added, a ferrocyanide of copper separates on standing some time: whether this is a proto or diferrocyanide I am unable to say. I have also noticed that occasionally a few particles of a dark-looking compound separate, when solid potassium cyanide is used to dissolve the ferricyanides of copper and cadmium. The formation of this compound occurs immediately around the solid potassium cyanide, but seems to disappear by shaking or gently warming.

In regard to cadmium, Fresenius says it is weighed either as an oxide or a sulphide, giving the preference to the oxide. Yet he states that all compounds of cadmium, without exception, may be weighed as a sulphide, and the results are accurate.

The method of precipitation by hydrosulphuric acid has several objections; for example, you must not have a strong acid solution, much HCl and HNO_3 interfering with the complete precipitation.

The cadmium sulphide is almost invariably contaminated with sulphur, which must be dissolved out with carbon disulphide, which the chemists will, I think, generally agree with me is more or less a troublesome and disagreeable operation; or the sulphide may be boiled with sodium sulphite.

Sulphur does not separate in a solution containing potassium cyanide, when a metal is precipitated by hydrosulphuric acid, or ammonium sulphide; therefore my mode of procedure would not have the objection stated above.

PROCEEDINGS OF SOCIETIES.

BRITISH PHARMACEUTICAL CONFERENCE.

MEETING OF EXECUTIVE COMMITTEE.

July 5th, 1876.

PRESENT:—Professor Redwood, President; Messrs. Frazer, Williams, Carteighe, and Schacht, Treasurer; Professor Attfield, Honorary Secretary; and Mr. Davies, Assistant-Secretary.

Thirteen candidates were elected to membership.

The names of several members, whose subscriptions were more than two years in arrear, and to whom repeated written applications had been made by the secretaries, were removed from the lists.

Twenty-six subjects proposed for research were received and considered.

Professor ATTFIELD suggested that some competent member should be employed to revise and somewhat elaborate the "subjects for papers" named in the current list issued by the Conference. In the course of thirteen years the Conference had proposed some two hundred subjects for research, of which nearly one hundred had since been investigated, resulting papers forming about one-third of the three hundred papers which had been read at the twelve annual meetings of the Conference. The one hundred or so of subjects now on the list, especially the fifty or sixty which had been down for several years, required careful revision, information concerning any work already accomplished being added to each subject, and some hints given as to the direction which further investigation should take. Probably a few of the subjects might now be excluded from the list altogether.

The secretaries were ordered to give effect to the suggestion.

The EDITOR reported good progress in the preparation of the MS. of the "Year Book of Pharmacy" for 1876.

Professor ATTFIELD reported that since the previous meeting of the committee he had issued about 2500 copies of the current Year-Book.

NOTICES OF BOOKS.

Legal Chemistry: a Guide to the Detection of Poisons, Examination of Stains, &c., as applied to Chemical Jurisprudence. By A. NAQUET. Translated, with additions, by J. P. BATTERSHALL, Nat. Sc.D., with a Preface by C. F. CHANDLER, Ph.D. M.D., &c. New York: Van Nostrand.

THE title-page of this book shows a step in the right direction. We are glad to see such misleading and illogical terms as "legal medicine," "forensic medicine," and "medical jurisprudence" replaced by the more accurate expressions used by our authors. The plan of the work before us is extensive, almost too much so for its compass of 178 pp. In addition to toxicology we find instructions for the detection of adulterations in articles of food and medicine, for the examination of blood-stains, &c., on weapons, clothing, &c., the determination of the nature of hair, and of its original colour, the examination of writings, of sympathetic inks, of suspected coins and alloys, and of human remains in the ashes of a fire-place. The section on alimentary and pharmaceutical substances may be pronounced thoroughly unsatisfactory. It embraces merely flour and bread, olive, colza, hemp-seed, and linseed oils, milk, wine, vinegar, and sulphate of quinine. The remarks on milk are evidently based upon old and erroneous analyses, since M. Naquet states that "good milk leaves upon evaporation 7·5 to 9·5 per cent of solid matters." We have heard a complaint that even the standard of the Society of Public Analysts (11·5 per cent) has proved an encouragement to fraud, since milks are now carefully let *down* to this point. The lactometer, the lactoscope, and Marchand's instrument have now merely a historical interest, and it is surprising that they should be noticed in a practical manual. The directions for the examination of bread are little better. An analyst who should undertake the detection of alum by the method indicated in the text would be equally successful in its presence or in its absence. The reader is not even cautioned against the very possible presence of alumina and silica in his caustic alkali. The translator, to do him justice, adds a foot note, in which some of the shortcomings of the author are supplemented.

Under wine, we are told that the "most common adulteration is the addition of water!" With us, at least, the most common adulteration is the addition of extraneous alcohol, generally rich in amylic compounds. On the detection of this fraud and on "plastering" nothing is said. Why coffee, chocolate, tea, sweetmeats, &c., should be left out of sight does not appear.

The section on the recognition and discrimination of blood-stains is more in harmony with modern requirements. The author, however, observes:—"In the present state of science it is impossible to discriminate chemically between human and animal blood. M. Barruel, it is true, is able not only to accomplish this, but also to distinguish the blood of the various species of animals by its odour. But this test has a somewhat hypothetical value for scientific purposes."

We have all due respect for the nose as a preliminary instrument of qualitative research. Nor do we question that the flesh and the blood of different species, or at least groups of animals, may have a distinct specific odour. But remembering that the sense of smell varies exceedingly in delicacy, and that the whole amount of blood involved in such investigations is often very small, we think this test utterly inadmissible.

Nor can we speak with any favour of the instructions for the detection of human remains in the ashes of a fire-place. The author, indeed, practically admits their worthlessness when he says—"These indications, however, are reliable only when the certainty exists that the bones of animals have not been consumed in the same fire-place." How often is this certainty so absolute that a judicious chemist could presume to infer the presence of human remains from the occurrence of nitrogenous matter and phosphate of lime? The author justly points out the fallacious character of another supposed indication:—"It has been stated that the disengagement of sulphuretted hydrogen upon treating the ashes with sulphuric acid is an indication that the combustion of a human body has occurred (!) This reaction is, however, valueless, inasmuch as coal and certain vegetable ashes likewise evolve the same gas when subjected to the same treatment." We cannot help wishing to know what chemist can first have made so absurd a suggestion.

The section on the chemical examination of written documents supposed to have been tampered with is very interesting. The following passage exposes an ingenious fraud, against which the public should be put on their guard:—"The expert may possibly be called upon to give evidence as to the existence of a '*trompe l'œil*,' as was the case in the trial of M. de Preigne, which took place at Montpellier in 1852. A '*trompe l'œil*' consists of two sheets of paper glued together at the edges, but having the upper sheet shorter than the other, which, therefore, extends below it. This species of fraud is executed by writing unimportant matter on the upper sheet and then obtaining the desired signature, care being taken that it is written on the portion of the paper projecting below. The signature having been procured it is only necessary to detach the two sheets in order to have a blank paper containing the signature, over which whatever is desired can be inserted. The expert upon placing

pieces of moistened paper upon the suspected document noticed that they adhered to certain points, and that these formed a border around the paper, but passing *above* the signature."

We think that without great nicety of manipulation on the part of those carrying out this fraud the signator might easily notice the greater thickness of the body of the document as compared with the part where he is requested to sign.

One of the most valuable features of the work is an appendix, added by the translator, containing the bibliography of toxicology and its kindred branches of analytical chemistry. Not only independent works are here given, but all memoirs and papers in the leading scientific journals and in the transactions of learned societies, the whole forming a most useful index.

The Retrospect of Medicine. Edited by W. Braithwaite, M.D., and Jas. Braithwaite, M.D. Vol. lxxiii. January to June, 1876. London: Simpkin and Marshal.

This half-yearly issue, though replete with matter interesting to the medical practitioner, contains nothing of importance to the chemist. We find chloride of lead recommended as a deodoriser and disinfectant, and pronounced "the most powerful and economical agent for eliminating sulphide of hydrogen from the atmosphere, as well as from all organic matter in a state of decomposition or putridity."

Remarks on the Purification of Water and other Things. By Lewis Thompson, M.R.C.S. Newcastle-upon-Tyne: Daily Journal Office.

For the purification of water the author recommends aluminite, the tribasic sulphate of alumina, or the same compound artificially prepared. He is, however, no believer in the "disease producing matters in water," and considers that the "proofs and evidences have wholly failed to establish any connection between the water and any disease whatever." There is no outcry made about purifying the air, because there is nothing to be got out of it. "It won't pay, and consequently it cannot be 'sanitarised.'"

We commend the following passage to the attention of all who pay, or are intending to pay, millions for having their sewage carried out to sea, and poured, as they fondly think, into deep water:—"There is a very interesting and even amusing circumstance connected with the waste of fertilising matters by the barbarous system called sewerage, and this circumstance admits of a happy illustration in the case of the existing metropolitan waste. We will now examine what must of necessity happen when the London sewage is sent from the mouth of the Thames. That sewage is lighter than sea-water, and consequently floats upon and does not mix with it, a fact very well known to the captains of our ships, who, though perhaps prevented by fogs from seeing the land, know well when they are approaching the mouth of a river by the change in the colour of the water. The sewage, therefore, floats on the surface of the sea, and the most valuable portions of the sewage, which are also the most offensive, are not destroyed or got rid of in the way expected by the sewage scheme projectors, but find their way to the nearest shore, where they serve as food for animals. And what are the names of those animals? The two most numerous are the mussel and the oyster; the very animals which are collected by man and sent up to London as food for the inhabitants, thus showing that an

> Even handed justice
> Returns the ingredients of our poisoned chalice
> To our own lips.

Much of this, quaintly and humorously as it is put, is only too true.

CORRESPONDENCE.

REACTION OF CHROMIC ACID WITH HYDRIC PEROXIDE.

To the Editor of the Chemical News.

Sir,—I think that the result of a few observations on the action of hydric peroxide upon chromic acid may not prove uninteresting, and may possibly be useful in the course of a qualitative analysis. It has been before observed that hydric peroxide, when poured into a solution of chromic acid, produces a considerable change in the liquid. If, however, the liquid be first treated with a small quantity of ether, and after the addition of the hydric peroxide it be well agitated, a blue colour will be apparent in the etherial portion of the solution. This reaction I have been led to use as a test thus. To the solution in a small test-tube I add, first, a quantity of ether sufficient to form a layer of from 3 to 4 millimetres in thickness. I then add a few drops of a solution of hydric peroxide, and agitate the whole together by inversion. If no blue colour is then apparent in the etherial solution I add a few drops of strong hydric nitrate and a few more drops of hydric peroxide, and re-agitate the whole, when, if a chromate be present, a blue colour will develop itself in the etherial layer. I have thus been enabled to detect the presence of chromic acid in a solution containing only $\frac{1}{5000}$ of its weight of potassic anhydro-chromate, corresponding to about $\frac{1}{7500}$ of chromic acid. As far as I have seen, this test is unaffected by the presence of nickel, cobalt, iron, manganese, aluminium, and other metals likely to occur in connection with chromium. It is, however, affected by the presence of hydric acetate, which causes the ether to dissolve in the aqueous solution, thereby rendering the blue colour very much less distinct. It is also necessary for the success of the test that there should be no free alkalies present, as they completely discharge the blue colour from the etherial solution.—I am, &c.,

R. H. C. Neville.

Chemical Laboratory,
Catholic University College, Wright's Lane, Kensington.

DETERMINATION OF MANGANIC OXIDE.

To the Editor of the Chemical News.

Sir,—In reply to Mr. Allen's query in the Chemical News (vol. xxxiv., p. 8), that gentleman will find the information he requires in any standard work on analytical chemistry—for instance, in H. Rose, vol. ii., p. 110 (French edition). But to save him the trouble of referring to any work, I may state that I discovered the manganic oxide in a very simple manner; namely, by determining in the first place the total quantity of oxygen, and in the next the total quantity of manganese. These two data are quite sufficient for the purpose. I think Mr. Allen might hesitate before he accuses chemists of counting oxygen twice over, especially when demanding advice upon so very simple a subject.—I am, &c.,

T. L. Phipson, Ph.D.

London, July 9, 1876.

INNS OF COURT PUMPS.

To the Editor of the Chemical News.

Sir,—You have propable observed in the *Daily News* of the 27th ult., a statement by Mr. W. Foster that New River water contained, "a short time ago," 0·004 gr. of ammonia per gallon, or, to express this in more convenient language, 0·0057 part per 100,000. I have recently made a number of analyses of New River water

and found it remarkably free from ammonia, containing even less than 0·001 part per 100,000. Referring also to the Registrar General's Reports of the present year, as far as I have them at the present moment before me, I find that New River water was free from ammonia in January, February, and April, containing in March only 0·001 part per 100,000. As the figure stated by Mr. Foster would convey to any one at all acquainted with London water the notion of a most alarming deterioration of the New River water, you will I hope excuse my troubling you with these lines.

Mr. Foster's statement that nitrates are among the characteristic constituents of sewage is evidently a slip of the pen, the reverse being the case.—I am, &c.,

GUSTAV BISCHOF.

Analytical Laboratory, 4, Hart Street, Bloomsbury, London, July 8, 1876.

DR. J. W. HEARDER, F.C.S.

To the Editor of the Chemical News.

SIR,—May I ask why Mr. R. Meldola should have selected Mr. Hearder in particular as having degraded the Chemical Society by use of the F.C.S. after his name in an advertising or trade pamphlet.

There are two trade advertisements in your impression of this week containing these initials, yet I think it would be very hard to charge Mr. J. J. Griffin (one of the advertisers) with trumpeting the F.C.S. for trade purposes; it would be useless to do so, for the high character and scientific attainments of that gentleman are too well known. Mr., or more correctly speaking, Dr. Hearder is well known in the West of England as a man of great ability, and especially is he respected and his talents recognised by the inhabitants of Plymouth, where he has laboured hard for the progress of science, and the number of his pupils that have obtained honours in chemistry and experimental physics at the public examinations will speak for itself.

Dr. Hearder has been blind for many years, and anyone who has attended his lectures, carried out, as they must have been, under great difficulties, will agree that instead of bringing discredit on the Chemical Society he has been an honour to it.—I am, &c.,

F.C.S.

FORMATION OF OZONE BY THE CONTACT OF PLANTS WITH PEROXIDE OF HYDROGEN.

To the Editor of the Chemical News.

SIR,—Under the above heading, Mr. S. Cohné, in the CHEMICAL NEWS (vol. xxxiv., p. 4) describes a few simple experiments, which, according to his interpretation, demonstrate that plants, by contact with peroxide of hydrogen, develop ozone. But the evidence he adduces is not sufficient to my mind to justify his deduction.

The results he obtained are as readily explicable on the view that the oxygen generated carries up with it a thin film or cloud of the aqueous solution containing peroxide of hydrogen, which latter body acts upon the potassic iodide (which was the reagent he employed as a test) with the same result as ozone. Inasmuch, therefore, that the test Mr. S. Cohné employed is one as readily susceptible to the influence of peroxide of hydrogen as to that of ozone, it is premature to write of the formation of ozone in this way.

It is in all probability a simple decomposition of peroxide of hydrogen into water and nascent oxygen. I have on several occasions conducted such experiments, and have further thought that the decomposing influence resided in the fibrin of the plant, an idea which derives some support from the fact which Mr. S. Cohné points out, that a stem is more active where it has been cut through.

Animal fibrin is known to have this character in a high degree, and, indeed, it serves as one of the best tests for peroxide of hydrogen, while the latter serves a reciprocal purpose for fibrin. All facts regarding the various states of oxygen are of interest, because it is probable that oxygen may exist in several other forms to those with which we are at present acquainted.

Thus Odling has (CHEMICAL NEWS, vol. xxvi., p. 296) suggested the existence of a variety of oxygen, "the weight of any given volume of which, like that of a given volume of phosphorus vapour, shall furnish the weight of the element contained in four such volumes of its several simplest compounds;" and of yet another variety of oxygen, "the weight of any given volume of which, like that of any given volume of mercury vapour, shall furnish but the weight of the element contained in the same volume of its several simplest compounds."

Schönbein viewed every slow oxidation as attended by the formation of ozone, and taking the use of this word to imply, not the definite body bearing that name, but a state of activity of oxygen, this appears to be true. Moreover, I have noticed that peroxides, such as those of lead and manganese, variously prepared and of accepted purity, when heated in vacuous tube, give oxygen which has the power of liberating iodine from potassic iodide. But not enough is known of these matters to admit of an acceptable interpretation.—I am, &c.,

CHARLES T. KINGZETT.

Pathological Laboratory, 68, Earl's Court Road, Kensington, W.

SALARIES OF PUBLIC ANALYSTS.

To the Editor of the Chemical News.

SIR,—From the subjoined advertisement which I extract from the *Dublin General Advertiser*, it would appear that some of the Irish Grand Juries have peculiar views in regard to the importance of recent sanitary legislation and the status of chemists.

COUNTY OF LOUTH.

PUBLIC ANALYST.—The Grand Jury of this county will, at the ensuing Summer Assizes, receive Applications, and appoint a fit and proper person to fill the office of Public Analyst for said county, at a salary not exceeding Ten Pounds per annum, as arranged by the county at large Presentment Sessions.

T. F. FILGATE, Secretary to Grand Jury.

County Court House, Dundalk, June 23, 1876.

None of the gentlemen who have arranged this salary would consider two pounds ten shillings per quarter sufficient wages for a stable boy. It is to be hoped for the honour of the chemical profession that the number of applications for the vacant post may be limited.—I am, &c.,

PUBLIC ANALYST.

July 10, 1876.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances, de l'Academie des Sciences. No. 24, June 12, 1876.

Experimental Criticism on Glycæmia: Physico-Chemical and Physiological Conditions to be Observed for the Detection of Sugar in the Blood.—M. C. Bernard.—Not adapted for abstraction.

Absorption of Free and Pure Nitrogen and Hydrogen by Organic Matters.—M. Berthelot.—The author describes his experiments and the apparatus employed.

Formation and Decomposition of Binary Compounds by the Electric Effluve.—M. Berthelot.—The action of the *effluve*, like that of the spark, tends to resolve compound gases into their constituents with the production of phenomena of equilibrium due to the inverse tendency to re-combination.

Electric Transmissions through the Soil.—M. Th. du Moncel.—Not capable of useful abstraction.

Certain New Experiments made with the Radiometer of Mr. Crookes.—M. A. Ledieu.—The radiometer was found to continue revolving when submitted exclusively to a pencil of luminous rays falling parallel to its axis. The author, however, does not draw the conclusion to which a superficial and systematic examination of this result might seem to lead. The experiment performed by M. Salleron at the suggestion of the author condemns decidedly the doctrine of emission as an explanation of the movement of the radiometer.

Law of Dulong and Petit.—M. Terreil.—The product of the specific heat by the chemical equivalent is a constant, on condition that all the bodies are taken of the same gaseous volume and before all condensation. The specific heat of elementary bodies taken at the same volume in the gaseous state is inversely as their chemical equivalents. The specific heat of compound bodies, under the same condition, is inversely proportional to their chemical equivalents, and proportional to the condensation which the gaseous volumes of the simple bodies constituting them have undergone on combining. Simple or compound bodies which have lost the gaseous state have a specific heat double that which they possessed when in the state of gas.

Phenomena of Electric Oscillation.—M. L. Mouton. —Not adapted for abstraction.

On Propylenic Chlorhydrines and on the Law of Addition of Hypochlorous Acid.—M. L. Henry.—A purely hypothetical paper, in which the author combats the views of M. Markownikoff.

Elementary Analysis of Electrolytic Aniline-Black. —M. Fr. Goppelsrœder.—The black analysed had been obtained by passing the galvanic current through an aqueous solution of pure hydrochlorate of aniline. The deposit formed at the positive electrode was purified by successive treatments with water, alcohol, ether, benzin, and again with alcohol. After this purification the substance was then dried at 110°, and appeared as a velvet-black powder. The mean result of 11 analyses was :—

Carbon	71·366
Hydrogen	5·241
Nitrogen	15·327
Chlorine	8·941
	100·875

This composition leads to the formula $C_{24}H_{21}N_4Cl$. If boiled with a dilute solution of caustic potassa this substance loses all its chlorine and is changed into a black body of a crystalline appearance with a metallic reflection. The velvet-black powder is the mono-hydrochlorate of a base tetramine, $C_{24}H_{20}N_4$, which forms mono-acid salts very readily. The black obtained by the electrolysis of hydrochlorate of aniline has the formula $C_{24}H_{20}N_4+HCl$, and that from the sulphate must therefore be, $2(C_{24}H_{20}N_4+H_2SO_4)$. If the electrolytic black is heated vapours of aniline are given off and a violet colouring matter sublimes. If aniline-black is treated in sealed tubes at not less than 190° (up to 150° there is no action) with aniline, methyl-diphenylamin, pseudo-toluydin, methyl-aniline, and nitro-benzin ; these substances attack the black and become coloured, aniline taking the violet, methyl-diphenylamin a brown, pseudo-toluydin a violet-brown, methyl-aniline a red-brown, and nitro-benzin a brown-red. Under analogous treatment alcohol takes a violet colour, the liquid giving the following reactions :— It is decolourised by hydrochloric and sulphuric acids, but the colour returns after neutralisation with ammonia. Chlorine water and sulphurous acid destroy it ; a small quantity of caustic potassa turns it blue, whilst an excess of the reagent renders it a violet-red. Nitric acid gives it a brown-violet shade, and acetic acid a brown, which returns to violet on saturation with caustic potassa. In like conditions the black is also attacked by iodide of ethyl, but the changes occasioned require further examination.

On Anthraflavon and an Accessory Product of the Manufacture of Artificial Alizarin.—M. A. Rosenstiehl.—The author showed in 1874 (*Comptes Rendus*, lxxix., p. 764) that the anthraflavon of Barth and Sennhofer if melted with caustic potassa gives simultaneous rise to two colouring matters, one of which, soluble in benzin and in alum water, dyes mordanted tissues shades bordering upon those of alizarin, whilst the other, insoluble in the same liquids, approaches purpurin ; the shades obtained in dyeing are, in brightness and solidity, comparable to those of madder. The former of these colours is produced in such small quantities that its examination has not been hitherto possible. The latter is more plentiful, and is an isomer of purpurin approaching the isopurpurin or anthrapurpurin of Perkin. Anthraflavon itself is a mixture of two isomers of alizarin distinguished by their behaviour with bases. The one forms a soda salt very soluble in water ; it dissolves in baryta water, which it colours a deep orange yellow, combines with gelatinous alumina to form an orange lake, and if melted with caustic potash between 135° and 150° it forms the isomer of purpurin just mentioned. The other yields a soda salt sparingly soluble, and readily crystallisable ; it is insoluble in cold baryta water, does not combine with gelatinous alumina, and if melted with potassa at the same temperature it does not give rise to a colouring matter ; a little only is formed at a higher temperature, with the destruction of a large proportion of the substance. This second body can be obtained in the form of fine silky needles, which in bulk present the yellow colour of chromate of lead, and recalls the aspect of chrysophenic acid. This body is identical with an accessory product of the manufacture of artificial alizarin from the works of Przibram and Co., of Praz.

Bulletin de la Société d'Encouragement pour l'Industrie Nationale, No. 30, June, 1876.

Deposits of Fossil Phosphate of Lime in the Departments of Ardennes and La Meuse.—An account of the phosphatic strata, and of the mining operations carried on. The phosphoric acid in the nodules varies from 16·3 to 31 per cent, the oxide of iron ranging from 4·30 to 15·65 per cent. The amount of alumina present is not specially determined but included under the somewhat vague heading "sand and clay."

Reimann's Farber Zeitung, No. 22, 1876.

J. Wagner proposes to protect alizarin steam reds from the injurious action of the steel "doctors" by adding 20 grms. sulphocyanide of potassium to each litre of colour. Sulphocyanide of ammonia is not effective.

No. 23, 1876.

Häitra is the name of a vegetable substance recently introduced into commerce for thickening colours and giving body to textile wares. To prepare it for use, it is first washed, and then boiled at 130° in a closed vessel with 60 parts of water.

MISCELLANEOUS.

American Chemical Society.—At a meeting of American chemists, held in April last at the New York College of Pharmacy, it was resolved to form a society, to be called "The American Chemical Society," and at a subsequent meeting the following officers and committees were appointed :—*President*—John W. Draper. *Vice-Presidents*—J. Lawrence Smith, Frederick A. Genth, E. Hilgard, J. W. Mallet, Charles F. Chandler, Henry Morton. *Corresponding Secretary*—George F. Barker. *Recording Secretary*—Isidor Walz. *Treasurer*—W. M. Habirshaw. *Librarian*—P. Casamajor. *Curators*—Edward Sherer, W. H. Nichols, Frederick Hoffmann. *Committees on Papers and Publications*—Albert R. Leeds, Herrmann Endemann, Elwyn Waller. *Committee on Nominations*—E. P. Eastwick, M. Alsberg, S. St. John, Charles Fröbel, Chas. M. Stillwell.

Experiments with Frozen Dynamite.—Some interesting experiments were recently made at the works of the British Dynamite Company at Stevenston, Ayrshire, with the view of proving that dynamite in a frozen state is as safe to handle and to transport as in an unfrozen state. Professors James Thomson and Bottomley, of the University of Glasgow, were present. In the first experiment several cartridges in a frozen state, and in some parts beginning to thaw, were thrown one by one from the hand, with great force, against an iron plate without explosion. In the second experiment, a block of iron, about 400 lbs. weight, was allowed to fall from a height of about 20 feet on a light wooden box containing 20 lbs. of dynamite cartridges in a frozen state, and with slight signs of incipient thawing in spots more exposed to the warmth of the air. The box was smashed, and the cartridges were crushed flat and pounded together, but there was no explosion. The crushed cartridges were next made up into two heaps to be exploded. The ordinary detonator shatters but does not explode the frozen dynamite. The explosion was therefore effected by inserting in each heap a small unfrozen cartridge, with the ordinary detonator inserted into it, and then firing this off by a Beckford fuse. The two heaps were exploded successively, and it is worthy of remark that the explosion of the first, though very violent, did not set the other off.

British Association for the Advancement of Science.—The following are the officers of the forty-sixth annual meeting of the British Association which will commence at Glasgow on Wednesday, September 6th, 1876:—*President designate*—Prof. Thos. Andrews, M.D., LL.D., F.R.S., Hon. F.R.S.E., in the place of Sir Robert Christison, Bart., who has resigned the Presidency in consequence of ill health. *Vice-Presidents elect*—His Grace the Duke of Argyll, K.T., F.R.S., &c.; the Lord Provost of Glasgow; Sir William Stirling Maxwell, Bart., M.A., M.P.; Prof. Sir William Thomson, D.C.L., F.R.S., &c.; Prof. Allen Thomson, M.D., LL.D., F.R.S., &c.; Prof. A. C. Ramsay, LL.D., F.R.S., &c. *General Secretaries*—Capt. Douglas Galton, C.B., D.C.L., F.R.S., &c.; Dr. Michael Foster, F.R.S. *Assistant General Secretary*—George Griffith, M.A., F.C.S., &c. *General Treasurer*—Prof. A. W. Williamson, Ph.D., F.R.S. *Local Secretaries*—Dr. W. G. Blackie, F.R.G.S.; James Grahame; J. D. Marwick. *Local Treasurers*—Dr. Fergus; A. S. M'Clelland. The President of Section A (Mathematical and Physical Science) will be Prof. Sir Wm. Thomson, D.C.L., F.R.S.; of Section B (Chemical Science), Mr. W. H. Perkin, F.R.S. On Thursday evening, Sept. 7th, at 8 p.m., there will be a *Soirée*; on Friday evening, Sept. 8th, at 8.30 p.m., a Discourse; on Monday evening, Sept. 11th, at 8.30 p.m., a Discourse by Prof. Sir C. Wyville Thomson, F.R.S.; on Tuesday evening, Sept. 12th, at 8 p.m., a *Soiree*; on Wednesday, Sept. 13th, the concluding general meeting will be held at 2.30 p.m.

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THE CHEMICAL NEWS.

Vol. XXXIV. No. 869.

ON

REPULSION RESULTING FROM RADIATION. INFLUENCE OF THE RESIDUAL GAS.*

(Preliminary Notice.)

By WILLIAM CROOKES, F.R.S., &c.

I have recently been engaged in experiments which are likely to throw much light on some obscure points in the theory of the repulsion resulting from radiation. In these I have been materially assisted by Prof. Stokes, both in original suggestions and in the mathematical formulæ necessary for the reduction of the results. Being prevented by other work from completing the experiments sufficiently to bring them before the Royal Society prior to the close of the session, I have thought that it might be of interest were I to publish a short abstract of the principal results I have obtained, reserving the details until they are ready to be brought forward in a more complete form.

In the early days of this research, when it was found that no movement took place until the vacuum was so good as to be almost beyond the powers of an ordinary air-pump to produce, and that as the vacuum got more and more nearly absolute so the force increased in power, it was justifiable to assume that the action would still take place when the minute trace of residual gas which theoretical reasoning proved to be present was removed. The first and most obvious explanation therefore was that the repulsive force was directly due to radiation. Further consideration, however, showed that the very best vacuum which I had succeeded in producing might contain enough matter to offer considerable resistance to motion. I have already pointed out that in some experiments, where the rarefaction was pushed to a very high point, the torsion beam appeared to be swinging in a viscous fluid (194), and this at once led me to think that the repulsion caused by radiation was indirectly due to a difference of thermometric heat between the black and white surfaces of the moving body (195), and that it might be due to a secondary action on the residual gas.

On April 5, 1876, I exhibited, at the *Soirée* of the Royal Society, an instrument which proved the presence of residual gas in a radiometer which had been exhausted to a very high point of sensitiveness. A small piece of pith was suspended to one end of a cocoon fibre, the other end being attached to a fragment of steel. An external magnet held the steel to the inner side of the glass globe, the pith then hanging down like a pendulum, about a millimetre from the rotating vanes of the radiometer. By placing a candle at different distances off, any desired velocity, up to several hundreds per minute, could be imparted to the fly of the radiometer. Scarcely any movement of the pendulum was produced when the rotation was very rapid; but on removing the candle, and letting the rotation die out, at one particular velocity the pendulum set up a considerable movement. Prof. Stokes suggested (and, in fact, tried the experiment at the time) that the distance of the candle should be so adjusted that the permanent rate of rotation should be the critical one for synchronism corresponding to the rate at which one arm of the fly passed for each complete oscillation. In this way the pendulum was kept for some time swinging with regularity through a large arc.

This instrument proved that, at a rarefaction so high that the residual gas was a non-conductor of an induction current, there was enough matter present to produce motion, and therefore to offer resistance to motion. That this residual gas was something more than an accidental accompaniment of the phenomena was rendered probable by the observations of Dr. Schuster, as well as by my own experiments on the movement of the floating glass case of a radiometer when the arms are fixed by a magnet.*

My first endeavour was to get some experimental means of discriminating between the viscosity of the minute quantity of residual gas and the other retarding forces, such as the friction of the needle-point on the glass cup when working with a radiometer, or the torsion of the glass fibre when a torsion-apparatus was used. A glass bulb is blown on the end of a glass tube, to the upper part of which a glass stopper is accurately fitted by grinding. To the lower part of the stopper a fine glass fibre is cemented, and to the end of this is attached a thin oblong plate of pith, which hangs suspended in the centre of the globe: a mirror is attached to the pith bar, which enables its movement to be observed on a graduated scale. The stopper is well lubricated with the burnt india-rubber which I have already found so useful in similar cases (207). The instrument is held upright by clamps, and is connected to the pump by a long spiral tube. The stopper is fixed rigidly in respect to space, and an arrangement is made by which the bulb can be rotated through a small angle. The pith plate, with mirror, being suspended from the stopper, the rotation of the bulb can only cause a motion of the pith through the intervention of the enclosed air. Were there no viscosity of the air, the pith would not move; but if there be viscosity, the pith will turn in the same direction as the bulb, though not to the same extent, and, after stopping the vessel, will oscillate backwards and forwards in decreasing arcs, presently setting in its old position relatively to space.

It was suggested by Prof. Stokes that it would be desirable to register not merely the amplitude of the first swing, but the readings of the first five swings or so. This would afford a good value of the logarithmic decrement (the decrement per swing of the logarithm of the amplitude of the arcs), which is the constant most desirable to know. The logarithmic decrement will involve the viscosity of the glass fibre, but glass is so nearly perfectly elastic, and the fibre so very thin, that this will be practically insensible.

According to Prof. Clerk Maxwell the viscosity of a gas should be independent of its density; and the experiments with this apparatus have shown that this is practically correct, as the logarithmic decrement of the arc of the oscillation (a constant which may be taken as defining the viscosity of the gas) only slightly diminishes up to as high an exhaustion as I can conveniently attain—higher, indeed, than is necessary to produce repulsion by radiation.

I next endeavoured to measure, simultaneously with the logarithmic decrement of the arc of oscillation, the repulsive force produced by a candle at high degrees of exhaustion. The motion produced by the rotation of the bulb alone has the advantage of exhibiting palpably to the eye that there *is* a viscosity between the suspended body and the vessel; but once having ascertained that, and admitting that the logarithmic decrement of the arc of oscillation (when no candle is shining on the plate) is a measure of the viscosity, there is no further necessity to complicate the apparatus by having the ground and lubricated stopper. A movement of the whole vessel bodily through a small arc is equally effective for getting this logarithmic decrement; and the absence of the stopper enables me to have the whole apparatus sealed up in glass, and I can therefore experiment at higher rarefactions than would be possible when a lubricated stopper is present.

* A Paper read before the Royal Society, June 15, 1876.

* *Proc. Roy. Soc.*, March 30, 1876.

The apparatus, which is too complicated to describe without a drawing, has attached to it—*a*, a Sprengel pump; *b*, an arrangement for producing a chemical vacuum; *c*, a lamp with scale, on which to observe the luminous index reflected from the mirror; *d*, a standard candle at a fixed distance; and *e*, a small vacuum-tube, with the internal ends of the platinum wires close together. I can therefore take observations of—

1. The logarithmic decrement of the arc of oscillation when under no influence of radiation.
2. The logarithmic decrement of the arc of oscillation when a candle shines on one end of the blackened bar.
3. The appearance of the induction-spark between the platinum wires.

1 measures the viscosity; 2 enables me to calculate the force of radiation of the candle; and 3 enables me to form an idea of the progress of the vacuum, according as the interior of the tube becomes uniformly luminous, striated, luminous at the poles only, or black and non-conducting.

The apparatus is also arranged so that I can try similar experiments with any vapour or gas.

The following are some of the most important results which this apparatus has as yet yielded:—

Up to an exhaustion at which the gauge and barometer are sensibly level there is not much variation in the viscosity of the internal gas (dry atmospheric air). Upon now continuing to exhaust, the force of radiation commences to be apparent, the viscosity remaining about the same. The viscosity next commences to diminish, the force of radiation increasing. After long-continued exhaustion the force of radiation approaches a maximum, but the viscosity measured by the logarithmic decrement begins to fall off, the decrease being rather sudden after it has once commenced.

Lastly, some time after the logarithmic decrement has commenced to fall off, and when it is about one-fourth of what it was at the commencement, the force of radiation diminishes. At the highest exhaustion I have yet been able to work at, the logarithmic decrement is about one-twentieth of its original amount, and the force of repulsion has sunk to a little less than one-half of the maximum. The attenuation has now become so excessive that we are no longer at liberty to treat the number of gaseous molecules present in the apparatus as practically infinite; and, according to Prof. Clerk Maxwell's theory, the mean length of path of the molecules between their collisions is no longer very small compared with the dimensions of the apparatus.

The degree of exhaustion at which an induction-current will not pass is far below the extreme exhaustions at which the logarithmic decrement falls rapidly.

The force of radiation does not act suddenly, but takes an appreciable time to attain its maximum; thus proving, as Prof. Stokes has pointed out, that the force is not due to radiation *directly*, but *indirectly*.

In a radiometer exhausted to a very high degree of sensitiveness, the viscosity of the residual gas is almost as great as if it were at the atmospheric pressure.

With other gases than air the phenomena are different in degree, although similar in kind. Aqueous vapour, for instance, retarding the force of repulsion to a great extent, and carbonic acid acting in a similar though less degree.

The evidence afforded by the experiments of which this is a brief abstract is to my mind so strong as almost to amount to conviction that the repulsion resulting from radiation is due to an action of thermometric heat between the surface of the moving body and the case of the instrument, through the intervention of the residual gas. This explanation of its action is in accordance with recent speculations as to the ultimate constitution of matter, and the dynamical theory of gases.

ON THE ACTION OF CERTAIN KINDS OF FILTERS ON ORGANIC SUBSTANCES.

Part IV.

By J. ALFRED WANKLYN.

In continuing my investigation I have experimented on a solution of strychnine. In 10 litres of London Thames water (West Middlesex Company), which yielded 0·05 m.grm. of albuminoid ammonia per litre, I dissolved 1·263 grms. of strychnine, using a little hydrochloric acid (about 5 c.c. of the strong acid) to facilitate the solution.

As will be seen, this solution contains 0·1263 grm. of strychnine per litre, or 8·841 grains per gallon. Such a solution is bitter to the taste. I drank 5 c.c. of it, and found it to be very bitter.

Submitted to the "ammonia process" the solution yielded 5·20 m.grms. of albuminoid ammonia per litre.

In making the experiment on the filtration of this solution I desired to ascertain whether or not the silicated carbon filter preserves its power, and accordingly employed the same filter which had already absorbed quinine and morphia in previous experiments. Already the filter had taken up about 0·7 grm. of acid sulphate of quinine and 1·3 grms. of hydrochlorate of morphia, and since taking up these alkaloids had not had very large quantities of water passed through it. The filter was very carefully drained of water, and then the 10 litres of the above-described solution of strychnine placed in it. The first 5 litres of filtrate were thrown away, and the remainder was collected.

Submitted to the ammonia process it yielded some free ammonia and 0·04 m.grm. of albuminoid ammonia per litre, which shows that the filtrate was devoid of strychnine.

I have sufficient confidence in the ammonia process to wager my life on the correctness of the results, and I drank 300 c.c. of the filtrate. It was not bitter, and I have not experienced any symptoms of poisoning with strychnine; and, as will be found on making the calculation, 300 c.c. of the unfiltered liquid contained about 40 m.grms. of strychnine, which is a poisonous dose.

ACTION OF SODIUM ON BENZOL.

I.

Some observers have stated* that when benzol is heated or digested with sodium it is decomposed or acted upon, but the nature of the product is not stated.

Why potassium or sodium should act upon a comparatively inert substance like benzol is not, from theoretic grounds, very evident.

To prove whether sodium has any action on C_6H_6 within a moderate range of temperature the following experiments have been made:—

Very pure benzol was prepared, by agitating the ordinary benzol with strong oil of vitriol for some days, washing with potassic hydrate, and distilling from water; it was then dried with calcic chloride, and rectified; after which it was further purified by several crystallisations, the crystals of benzol being pressed between (in a hand-screw press) each operation, to separate any uncrystallisable hydrocarbon which might remain.

This benzol boils constantly at 80·5° to 81°, and its vapour density and percentage composition, by combustion, agree very closely with the calculated numbers: 8 to 10 c.c. of this benzol, along with 1 to 1·5 grm. clean-cut sodium, was introduced into strong tubes (about 15 inches long), the benzol warmed so that its vapour expelled the air from the tubes, which were then sealed and heated in an oil-bath to 150° C. for four hours, at the end

* "Watts's Dictionary" (Benzene).

of which time a tube was examined, but the sodium showed no further signs of action than fusion into globules. The remaining tubes were then heated to 200° to 250° C. for eighteen hours, when very little change was apparent, and the surfaces of the sodium having only a very slight brownish tint.

On opening the tubes under mercury, no—or only a very minute quantity of—gas was found to have been produced, the mercury almost entirely filling the remainder of the tube not occupied by the liquid benzol.

The benzol distilled entirely away between 80° to 81° without leaving any residue.

Potassium in the presence of finely-divided silver had no more effect than the sodium alone.

Zinc, or the copper-zinc couple, is also without action at temperatures up to 150° C.

It was found unsafe to continue the action of sodium at temperatures much higher than 250° C., several violent explosions taking place, probably owing to the action of the fused sodium on the glass.

II.

If clean pieces of sodium or potassium be warmed under benzol in which phosphorus is dissolved, or pieces of sodium and phosphorus heated gently together under benzol, the surface of the metal becomes covered with a brilliant red film of amorphous phosphorus, which adheres very closely and prevents further action.

The same action takes place in the cold, the film appearing at first yellow. It forms very rapidly on boiling, when the red substance on its first formation has the appearance of melting on the surface of the containing vessel.

No metallic phosphide is formed at temperatures under 100° C., and the benzol is not affected.

W. R. H.

Royal College of Chemistry,
South Kensington, July, 1876.

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 5.)

Chlorine, Bromine, Iodine, and Fluorine.
By Dr. E. MYLIUS, of Ludwigshafen.

Chorine and Chloride of Lime.—By far the larger portion of the hydrochloric acid evolved in Leblanc's soda process is utilised in the preparation of chlorine as an intermediate product in the manufacture of chloride of lime. As is well known the native peroxide of manganese (pyrolusite) has long been employed for this purpose. As long as this mineral was to be found in sufficient quantity there was no occasion to seek out any substitute. By degrees the manganese mines became less productive, the samples in the market grew poorer in the effective ingredient, peroxide of manganese, and the prices became higher. Hence, on the one hand, experiments became necessary to re-convert the chloride of manganese—the residue from the production of chlorine—into peroxide, in order thus to reduce the outlay for maganese and to bring back a useless and troublesome residue into industrial circulation; on the other hand, attempts were made to produce chlorine without the intervention of manganese.

The first procedure for the regeneration of manganese from its residues which has met with a practical application is that of Dunlop; the chloride of manganese being decomposed by carbonate of lime, and steam at a pressure of from 2 to 4 atmospheres, and the carbonate of manganese thus formed being heated to 300° to 400° C. This procedure was carried out in the colossal establishment of Messrs. Tennant, at Glasgow, but has not been generally adopted among manufacturers of chlorine. It requires costly plant without accomplishing the required object—a perfect regeneration of the manganic oxide. An improvement on this process, although not industrially available, was that of Clemm* who substituted carbonate of magnesia for chalk. From the magnesium chloride formed by the decomposition of the manganese chloride he liberated hydrochloric acid by means of superheated steam, whilst the magnesia simultaneously formed was again applicable for the precipitation of fresh quantities of manganese solutions. This method, therefore, provided for the regeneration of the chlorine united with the manganese, which in Dunlop's original process was lost in the almost useless form of chloride of calcium. A method of regenerating manganese, very advantageous under certain circumstances, has been devised by F. W. Hofmann, and has been successfully introduced in the works at Dieuze, and in certain German establishments. The inventor combines the regeneration of manganese in a successful manner with that of sulphur.† Hofmann precipitates the solution of manganese with the yellow polysulphides of calcium obtained by the lixiviation of vat-waste after prolonged exposure to the air. The manganese sulphide thus obtained, containing 57·5 per cent of sulphur, is burnt, a part of the sulphur being recovered as sulphurous acid and conducted into the chambers. The residue is heated with nitrate of soda (1 mol. to 1 atom of manganese in the residue), and thus converted into a higher oxide of manganese, which is then transferred to the chlorine stills as a manganese of 55 per cent. Oxides of nitrogen are evolved at the same time, which, with the aid of water and air, can be condensed as nitric acid. The peroxide thus obtained consumes, indeed, 2 to 3 per cent more hydrochloric acid than native manganese, but is much more readily soluble.

Passing over other attempts at the same object, we may mention, as a curiosity, one process which proves, at least, how intense has been the desire to regenerate manganese. Esquiron and Gouin make the ingenious proposal to revivify manganese residues for the preparation of chlorine by means of chloride of lime!

(To be continued.)

* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzenends."

ON MEASURING AIR IN MINES.‡

By JOSEPH DICKINSON, F.G.S.,
H.M. Inspector of Mines.

ANEMOMETERS, or air-meters as they are often called, are now in common use for measuring the velocity of air-currents in mines. Forty years ago they were seldom seen. The methods then practised are described in the well known report prepared by Mr. James Mather, Honorary Secretary of the South Shields Committee appointed in the year 1839 to investigate accidents in mines. They were by the smoke of gunpowder or tobacco, and the regulated pace of a person by the flame of a candle. No mechanical appliance appears to have been in use. The report refers to an anemometer constructed by Mr. Thomas Elliot (a brother of the present baronet, Sir George) in 1835, when an overman of Pensher Colliery, which worked by "the air acting on four wands similar to a windmill, which met so strongly with the approval of the coal-owners that in that year, at their meeting at Newcastle-on-Tyne, they presented him with ten guineas for his invention, *but they did not adopt it in one of their mines.*"

* Clemm, *Dingl. Pol. Journ.*, clxxiii., 128.
† Compare Dr. F. Tiemann's remarks on the utilisation of soda residues in a subsequent part of the present report.
‡ A Paper read before the Manchester Geological Society.

The first anemometers which appear to have come into general use in mines were those of M. Charles Combes, of Paris, and Mr. Benjamin Biram, of Wentworh, Yorkshire, both being similar in principle to Mr. Elliott's. M. Combes, in his valuable work, "Traité de l'Exploitation des Mines, 1844," refers to a description of his anemometer written by him in the *Annales des Mines*, by which it appears that his anemometer was introduced in 1837. Mr. Biram's anemometer, it seems by the patent specification, was sealed August 3, 1842, the scope of it being for registering the velocity of bodies propelled through water or wind and employment for paddle-wheels, stern-propellers, and other rotary engines. M. Combes's instruments seem to have been made by M. Newman, of Paris, and Mr. Biram's by Mr. Davis, of Derby.

Robinson's anemometer, consisting of four revolving hemispherical hollow cups fixed on four arms radiating from a centre (as commonly used on observatories), have as yet been but little used in mines. It appears by F. Pastorelli and Co.'s work on standard instruments, and by other authorities, that this anemometer was invented by Dr. Robinson, of Armagh, and that it was used in tidal and meteorological observations on the coast of Ireland in 1850. It is also stated that Dr. Robinson, after a series of carefully conducted experiments, found that these cups fixed upon a vertical axis travel at the rate of one-third of that of the wind, and that this law exists irrespectively of the size of the cups or the length of the arms.

Another combination of the windmill anemometer has recently come into use in mines. The arrangement is attributed to Dr. Parkes, F.R.S., for whom it is said to have been originally made by Mr. Lowndes, a working instrument maker in London. This instrument is sometimes known as the Casella or Casartelli anemometer.

All windmill anemometers, it will be understood, require timing, and also correction, in order to ascertain the true velocity of the air from the number of revolutions.

Anemometers, "a mere inspection of which would enable an officer to ascertain in an instant the exact velocity of the air, without the necessity of timing or correcting," have long been known, but the only one that I know of as being in use in mines, is the one devised by myself about twenty-five years ago, which is known as the Dickinson anemometer. By means of this the velocity of the air may be read off at a glance. It consists of a light, counterpoised, flat fanplate, which is usually made of talc, and hung upon two fine bearings, so as to be easily moved by the air current. Alongside of the fan-plate there is a quadrant, graduated and figured—the figure up to which the fan-plate is blown being the velocity of the air, in feet, per minute. There is also a spirit-level for setting the instrument level. In using this instrument all that is requisite to ascertain the number of cubic feet of air passing per minute is to multiply the velocity indicated by the anemometer into the area in feet of the place where the observation is taken. These anemometers have been made only by Mr. Casartelli, of Manchester.

A modification of the Dickinson anemometer, which I have seen permanently fixed in the Bardsley Colliery, Ashton-under-Lyne, by Mr. George Wild, has the counterpoise made of a balance weight, which is worked by a chain over a pulley. For a fixture, like this, the chain and weight counterpoise appears to be an improvement, as the friction of the links of the chain over the pulley imparts steadiness to the fan-plate, and thus enables the average velocity to be better read in intermitting currents.

About the same time as the introduction of the Dickinson anemometer, Mr. John Phillips, of Cornwall, devised a similar instrument, except that, as I understand, it had no counterpoise.

M. Devillez has also introduced one on the same principle, but with a hollow cylindrical cup instead of the fan-plate.

Another, with a flat plate suspended by two rods, by Dr. Prestell, is described by Messrs. Negretti and Zambra, of London, in their illustrated catalogue for 1873.

Mr. William Peace, of Wigan, also patented an anemometer about twenty years ago, the moving power being from the action of air on a block of wood hung in the downcast shaft, from which, by means of a wire or cord, motion is given to a finger on a dial-plate above ground.

The foregoing anemometers are apparently the principal ones which have as yet been proposed for or actually used in mines. A variety of others, however, some of ancient date, have been used for measuring the wind on the surface.

The first anemometer of which there appears to be any record is attributed to Dr. Croune, in 1667, which, it is said, did not answer the purpose intended. Better instruments seem to have been invented by other scientific men during the last century. The modes of action comprised the compression of a spiral spring, the elevation of a weight round a centre acting at the arm of a variable lever, a bag of air communicating with a glass tube, in the form of a lengthened U, being sometimes substituted for the spring. An anemometer by Leslie depended on the principle that the cooling power of a current of air is equal to its velocity. Another instrument depended upon the evaporation of water, the quantity evaporated being proportional to the velocity of the wind, varying, however, one would suppose, according to the dryness of the wind.

Wolfius's anemometer, as described by him in 1746, consisted of four sails similar to those of a windmill, but smaller, turning on an axis. On the axis is a perpetual screw, which turns a vertical cog-wheel round a second axis. To the second axis is attached a bar on which a weight is fixed, so that the sails cannot turn without moving round ths bar in a vertical circle. When the wind acts upon the sails the bar rises, and this continues until the increased leverage of the weight furnishes a counterpoise to the moving force of the wind. It also appears to have acted by winding up a weight.

Regnier's anemometer indicated the pressure upon a dial-plate, the moving power being a flat wooden surface on which the air acted, pressing it into a box with springs and mechanism.

The anemometers of Dr. Whewell and Mr. Osler are described in Sir W. Snow Harris's report to the British Association, in 1841-44. That of Dr. Whewell was by means of a windmill fly, which worked an intermediate train of wheels and caused the varying pressure to be marked on a fixed cylinder. Mr. Osler's traced the direction of the wind and its pressure on a given area, which was moved by clock mechanism. An invention by the Rev. W. Foster is also described as ingenious.

Lind's anemometer, which is an inverted glass syphon in the form of a U, is described in the *Philosophical Transactions*, 1775. An improvement of this has been made by Sir W. Snow Harris, who, by reducing one of the limbs to the diameter of one-fourth of the tube which is open to the wind, and by making the first part of the scale horizontal, has greatly increased the delicacy of the instrument. He also put a plumb on it, and a light vane, to facilitate observation.

As a water-gauge or manometer, the inverted glass syphon, known as Lind's anemometer, is identical with what is now commonly used in mines for measuring the pressure of air. The water-gauge introduced a few years ago by Mr. John Daglish, formerly of Hetton Colliery, Durham, is on the same principle.

M. E. Péclet, in his valuable "*Traité de la Chaleur*, Paris, 1860," says, that in 1820, M. Kallsténius employed a mill with twelve wands to measure the force of the air, and he describes M. Combes's anemometer. He also refers to a novel one by M. Morin, somewhat the same as M. Combes's. Also to the apparatus by M. Van Hecke, by which the ventilation is registered. Likewise to other instruments; in one instance by means of the air acting upon the surface of a body attached to one end of an arm working over a centre, there being a pointer at the other

end of the arm which indicates the force on a dial; and in another instance by the air acting upon hollow cylindrical cups hung in the current, by which a finger is worked on a dial plate. He also describes various water-gauges, both for ordinary and for great precision, including, amongst the latter, one having one of the limbs inclined.

These are apparently the principal anemometers which have as yet been introduced, either above or below ground. It is possible, however, that others may have been used, and even that some of them may have been invented by other persons than those whose names they now bear. Indeed, looking at the instruments generally, there is little more of any principle in them beyond what appears either in the windmill, or what may be exemplified by a light substance hung from a cord.

(To be continued.)

NOTES ON BLOWPIPE ANALYSIS.

By H. B. CORNWALL.

In a note published in the *American Chemist*, March, 1872, I stated that Van Kobell's iodide of potassium and sulphur test for bismuth gave also a marked reaction with lead compounds. The characteristic yellow sublimate which it affords with lead compounds is nearly as volatile as the real sublimate obtained by it with bismuth compounds, both of them being formed at a greater distance from the assay than the simple yellow coatings of oxides of lead and bismuth which frequently accompany them. The iodide of potassium and sulphur mixture constitutes a simple and very delicate test for lead, even in presence of a very large amount of bismuth, as experiments will show, and I direct the students to rely chiefly upon it; remembering only that the iodide of lead (?) sublimate is much more volatile than the simple yellow coating of oxide of bismuth or lead, which always lies near the assay. A few precautions are necessary in using the mixture as a test for lead, and also for bismuth to a certain extent.

Mercury compounds will often afford a yellow, sometimes a reddish sublimate with the mixture; sulphide of arsenic in large quantities, a yellow sublimate; sulphide of antimony, an orange, sometimes a reddish sublimate; cadmium compounds the yellowish brown coating of cadmium oxide, which might mislead beginners; all of these can be removed by a preliminary treatment with a moderate oxidising flame, to such an extent as not to interfere with the lead or bismuth reaction, and they should be so removed when present in large quantities. Finally, some tin compounds yield a yellowish sublimate with the iodide mixture, but it is very near the assay, and quickly becomes white on continuing the blast. These facts have partly been brought to my notice during practice with classes, and therefore will be of interest mainly to beginners, who are most liable to be deceived by the reactions given. The mixture is, however, highly to be recommended in testing for lead, having given indications of that metal in bronze and cadmiferous calamine, when all other blowpipe tests failed; the lead in the bronze was overlooked by an experienced chemist.—*American Chemist.*

University of Michigan.—We have received an account of the course of study pursued in the laboratory of analytical and applied chemistry in the University of Michigan: also a list of the professors, among whom we find the well-known name of Dr. A. B. Prescott, a list of the works used as authorities, &c.

PROCEEDINGS OF SOCIETIES.

NEWCASTLE-UPON-TYNE CHEMICAL SOCIETY.

General Meeting, March 23rd, 1876.

John Pattinson, President, in the Chair.

Discussion on Jones and Walsh's Decomposing Furnace.

(Concluded from p. 268.)

Mr. H. L. Pattinson said he had visited the works of Messrs. Jones and Co., and he had seen the first pan, and more recently the larger pan, in operation and he could certainly bear testimony to the fact of there being no gas escape. Of course he could not say anything as to the quantity of the gas condensed. He was very much satisfied with the admirable way in which the material seemed to be wrought. He never saw a more beautiful sulphate in his life. There was not a lump in it larger than the size of a hazel nut, and even these lumps when broken showed a perfect decomposition. He thought that if Mr. Jones would give them some of the tests of the sulphate they would be interesting. Those which he got when he was there were very good indeed. If he charged his memory rightly there was something like 1 per cent of free acid, showing probably that there was not a very high temperature, and there was a very small quantity of chloride—three-tenths per cent—showing that the decomposition was very perfect. He thought it would be well to supplement some of Mr. Jones's remarks also on that point; if by any accident an insufficient quantity of acid had been added to the salt, they could correct that by adding a little acid during the process and before the charge was withdrawn. It was only necessary to sprinkle in the additional estimated quantity of acid. That was very rapidly disseminated through the mass, and thus succeeded in bringing it to a perfect decomposition. On the other hand, if there was an excess of acid, it was only necessary to put in a little salt; that also was rapidly mixed by the action of the machine and took up any excess of free acid. He thought that the output, even of the furnace which Messrs. Jones now had at work, could be very largely increased by a better draught. He thought Messrs. Jones would probably agree with him that the deficient draught was probably owing to their having, from the nature of the place, been obliged to take the flue below the floor. It suddenly dropped from the roof of the furnace under ground, then rose again after a considerable distance, and as they all knew that a pulldown draught was disadvantageous, they would probably with a better arrangement of the draught get a better result. The first furnace, he thought, was working much more satisfactorily, and, for its size, turning out a larger quantity of sulphate. The draught was, at all events, sufficient, even in the large furnace, to do away with any nuisance such as we have even in our well-draughted open condensing furnaces. There was no nuisance when the charge was drawn, and they all as practical manufacturers, knew what a nuisance it was having the batches imperfectly wrought. There was no gas that he could complain of, and he thought nobody could. There was a little pungent odour, but nothing to be a nuisance. He was very much pleased with the whole thing, and thought that when little improvements were made in the way of charging, by a hopper on the top of the furnace probably, and also by the alteration of the gear, so as to draw the charge out through a slide in the furnace bottom, a great deal of time would be saved, and he should think that probably instead of their getting three batches out in the twenty-four hours, there would be no difficulty in getting out four. He would be very much disappointed if, in the furnace his firm had now ordered and were proceeding to erect, they did not get out 100 tons per week.

Mr. Newall said he went over to Middlesbrough and

saw the furnace at work and was very much pleased with it, and thought it did the work very well. Of course they all knew they were very much at the mercy of workmen now-a-days; and at Washington they had had the same cause of complaint which they had had at Middlesbrough. He regretted that Mr. Clapham had not informed them what steps had been taken previously in the same direction. If the records of the Patent Office were examined it would be found that some twenty-seven years ago Mr. William Pattinson, of the Felling, took out a patent for apparatus almost identical with that patented by Mr. Jones. The difference was very slight; and if Mr. Pattinson's plan was examined it would be found that it had been apparently much more well considered than the specification of Mr. Jones. The drawings attached to Mr. Pattinson's specifications were working drawings; in the other they were rather the reverse; but Mr. Pattinson showed clearly that his plan could be carried out for these furnaces. He had proposed two pans, and of course would do double the work in the same time that was done in one, or very nearly so; but the two processes appeared to him so identical that he could not conceive a patent taken out for this process now. The whole of the mechanical arrangement for the operation in Mr. Pattinson's plan was complete. He had gear which drove the stirrer at a certain speed during the process of decomposition, and when that was completed he reversed the mechanism by a clutch and drove the stirrers again at four times the speed, so as to expel the sulphate at the end of the operation four times as quickly as it was stirred up before. He thought it was worth looking at as a better contrivance than the one before them; but otherwise the two plans appeared to him to be identical.

Mr. H. L. Pattinson said he imagined that the essence of Mr. Jones's plan in opposition to his cousin, Mr. William Pattinson's patent was this—that the whole operation was completed in one pan and furnace.

Mr. Glover said that as Mr. Newall had mentioned the patent of Mr. Wm. Pattinson he might say that he happened to be at the Felling at the very time the plan was brought out and worked. He was there until it was discontinued, and he tested the products during the whole of the time. Unfortunately Mr. Wm. Pattinson did not carry out his process to the successful issue which Mr. Jones had done, and he thought that Mr. Wm. Pattinson would be the first to admit that that constituted a very strong claim to the patronage and sympathy of the trade. He recollected that at that time Mr. W. Pattinson's main object was to work balls. He worked the furnace for many months as a ball furnace. His great difficulty at that time was not so much keeping up the motion and working the material well, as to get a material for the tools which would stand the corrosive action of the sulphides. As Mr. Newall said, the machinery which was contrived and executed was almost perfect—the action of it was perfect. Mr. Pattinson saw it was necessary in applying it to a ball furnace, where the temperature was so high, to have a cooling apparatus, and he believed Mr. Pattinson specified water, though he used air. But he should think that at least twenty-five years had elapsed since the experiment was abandoned, and he thought that both morally, and even legally, Mr. Jones's patent deserved their support, and he believed that legally it would obtain it.

Mr. Jones said he was very glad Mr. Newall had named this matter, because it gave him an opportunity of explanation. His friend Mr. Hugh Lee Pattinson was himself over at their works amongst the first to see the furnace in operation, and at the time he told him of the furnace which had been designed by his relative, and also the use to which it had been applied; and he gathered from Mr. Pattinson's remarks at that time, that the main, if not the sole, use of this furnace was for carbonating.

Mr. Glover—We tried it for carbonating, but chiefly for balls.

Mr. Jones added that the machinery of it was described to him, but it was not till his return home from Sicily a few days ago that he was aware the furnace had been patented. The main principle of their patent was simply what had been described by Mr. Pattinson—that they did the whole of the operation at one time. They commenced and finished the operation, as it were, at one charge, and thus saved the labour of the twofold operation of having first to decompose the salt in one vessel, and then afterwards transfer it into another vessel to be finished, which, to his mind, would render the furnace of Mr. Pattinson, even supposing it had been applied to decomposing, so costly to work as to very largely, if not entirely, nullify the benefits to be obtained in their patent by cheapening labour.

Dr. Lunge said he had not seen the patent of Mr. Wm. Pattinson, but he was informed that Mr. Pattinson distinctly disclaimed the use of revolving machinery in the acid pans, and that constituted a very important difference. Of course, by that plan the breakage of the pans would be very much what it is at present.

Mr. Mond said he gathered, from what the several speakers had said, that the work in this furnace must be essentially different to the ordinary pan. Both Mr. Clapham and Mr. Jones remarked the evolution of the gas was constant, and he also gathered from Dr. Lunge, in conversation, that the mass never got into a solid state. If that were so, he should wish it to be explained; because, in that case, it was not only a new furnace, but an entirely new process in making sulphate, and appeared to him to be a very important innovation. Might he ask Mr. Jones to explain if he was right in this supposition?

The President thought that at one time, in the beginning of Mr. Jones's experiment, the mass was fluid at the commencement of the batch.

Mr. Jones—Not very fluid. The salt took the acid quickly.

The President—You added the salt very quickly?

Mr. Jones—Yes.

Mr. Glover—Have you ascertained accurately the percentage of sulphuric acid you used on the salt?

Mr. Jones said that Mr. Dyson, manager for Messrs. Muspratt, Bros., and Huntley, was over at their works last week, and took charge of the furnace while he was there. He was allowed to do what he liked with it. He weighed one charge of the materials taken, and the results were as follows:—Common salt, 3 tons 10 cwts.; sulphuric acid of 140°, equal to 2 tons 17 cwts. 3 qrs. of 170°.

Mr. Clapham—What percentage?

Mr. Jones said he had not worked it out, neither had Mr. Dyson, but it was 140° acid, equal to 2 tons 17 cwts. 3 qrs.

Mr. Glover—Of oil of vitriol?

Mr. Jones—Yes. The finished sulphate which he got out he weighed at 3 tons, 15 cwts., and estimated that he had left 5 cwts. of sulphate of soda in the furnace, making the total weight of sulphate of soda produced 4 tons. He could not get it all out; it was drawn out by a hand rake.

Mr. Hill said by that Mr. Jones would make out that he had used 82·5 per cent of acid of 170°, and got 114 per cent of sulphate upon the salt charged.

Mr. Jones said he had not worked it out.

Mr. Hill said this was what the figures which Mr. Jones had given brought out. There was just a doubt about the 114 per cent of sulphate on the salt charged, because the general experience on the Tyne led to a very much lower result, unless the salt was very dry.

Mr. Jones—The sulphate obtained was 4 tons.

Mr. Hill—Do you know the moisture in the salt?

Mr. Jones—No; but I think it was dry salt. You could not tell accurately from one batch.

Mr. Hill—That would account for a high percentage of sulphate.

Mr. Jones—There are no fluxings in this process. There is no possibility of any loss. I have not worked it

out in percentages. These are Mr. Dyson's results of his own work. He was allowed to have charge of the furnace for three days and two nights to do what he liked.

The President said the question which Mr. Mond wanted answered was this:—In what condition the salt and sulphuric acid were mixed together? Was all the salt put in at first, and a small quantity of acid added from time to time till all had been added? Or were the salt and acid put in in small quantities?

Mr. Walsh—We put in two tons of salt first to cover the pan bottom, and then turn on the acid tap, running the acid in in about twenty minutes, and then throw in the remainder of the salt.

The President—Is the whole of the acid put in at once?

Mr. Walsh—Yes; it takes twenty minutes to run in, in 5 ton charges, and while the acid is running, the rest of the salt is put in.

Mr. Glover—The batch is never fluid?

Mr. Walsh—Well, it is in what you may call a thick pulp. It never becomes thin as in the ordinary decomposing pan. It is pasty and stiff.

Dr. Lunge said he noticed specially the point which Mr. Mond had raised. It never became fluid, and there was not the slightest tendency to boil over. He asked if they used any tallow, and they said no.

Mr. Clapham, in reply to Mr. Mond, said the sulphuric acid was very strong, and there would not on that account be such a liquid mass in the furnace as if it was a very weak acid. The batches he saw worked were not what he would call fluid. They were sufficiently pasty—he thought that was the correct term to use—for the knives to go through.

Mr. Goodman thought he would not offer any observations as to theory, because what he could say was simply as to practice. He would much rather say something about the machine after trial. He thought a great deal of credit was due to Messrs. Walsh and Jones for the way in which they had worked out this furnace. He thought a great deal of time was lost between the filling in of the salt and the withdrawing of the charge. That was of course merely a mechanical operation which would probably require a little time to work out. He believed that the charge had taken five and a half hours to work, and if it took from eight to nine, he could see that it must be either from the laxity of the draught or the long time it took to feed the salt in and get it out, because it sometimes sticks a little to the bottom. But these were matters of detail, and he had no doubt that an hour and a half, or something like that, ought to be saved on each batch in twenty-four hours, so that practically he had no doubt they could turn out 20 to 25 per cent more sulphate with a more carefully considered arrangement. There had been an objection raised to the bottom door, but he believed that the principal objection to the arrangement was that it was a sliding one, and that if the door stuck they could not get at it. There was no objection to the drop door, it was simply the sliding door; and there had been a doubt expressed by some parties as to whether a bottom door could be made tight. He believed Mr. Walsh's practice went to show it could be easily made tight, and that there was not any doubt as to the tightness of the bottom door in his case; but as he said the simple difficulty was to get the slide out if it was stuck in the bottom. But these were all mechanical arrangements which he would rather not linger upon at present. At a future period they would no doubt have the opportunity of seeing the revised furnace for which he had drawn out the working plans. In a very short time one or two manufacturers would have them in work on the Tyne, and he was quite confident that the eighty tons which he thought Mr. Clapham spoke about in his paper could, first of all, be increased if the pan was about one-fifth more capacity than that of the pan which they were at present working. From one-fifth on eighty they would see what the result was, and by gaining about three or four hours out of the twenty-four they would have a further gain on the whole result. So that dealing simply with practical matters, he believed they would be able easily to get up to 100 or 120 tons. Of course there would be improvements made from time to time in this furnace. Some people still considered that over-head gear in matters of this kind was better than under gear. These were matters which only time could work out, at present what would suit one person's practice would not suit another's. For instance, when you brought the salt overhead it was more convenient to have under gear; under other circumstances it would be more convenient to have overhead gear. But these were mere matters of detail, and he thought they would be able to arrive at satisfactory conclusions if they satisfied their minds on the chemical portion of the work.

Mr. Pattinson, with respect to the wear and tear of the furnace, said, of course he had no experience, and probably no one had any experience, because it had not been in operation long. It was a most vital point, and time only could clear it up. Perhaps Mr. Jones would give them any results they had arrived at.

Mr. Jones said there was not much to be said upon that point. But the first furnace they put up was put up with a very slight pan; he thought the metal would not be more than 1½ inches thick. That pan was soon cracked, for the reason that all the work had been very home-made, and the pan put up too close to the fire; it was simply cracked by the heat of the fire, for being set upon pillars the radiation of heat caused unequal expansion. But, in the pan which he had described, which had been in regular work since last November, there was no appreciable wear and tear to this day. It had been carefully examined and measured in every part. There was an air-way between the edge of the pan and the fire, and therefore the fire had no direct effect upon it; and gentlemen would see that when there was no bottom heat going under the pan, and heat passing over a considerable distance above the surface of the pan, there was really very little risk of its breaking. He did not know what might be the life of a pan; it would be mere speculation to give a guess at it. But there was no visible wear and tear in the pan at this day, which was begun last November. With regard to the internal machinery, he had already stated, that while it was of wrought-iron there was a tendency in it to bend, especially when the charge became of a thick pasty state. The wrought-iron then having a considerable strain upon it, the arms were apt to bend a little out of shape. That, however, had not been observed since the wrought-iron arms had been replaced by metal arms, and that was the reason why the original furnace had been stopped, in order to have those wrought-iron arms taken out and metal arms put into it. There was no difficulty whatever in working it with metal arms of sufficient strength, and with metal scrapers and ploughs; and the wear was reduced practically to that upon the scrapers, and which was really very little. They only kept one smith at that class of work in their own works, and he really had nothing to do at this machine now. The smith used to be kept going constantly repairing the tools for the old decomposing pot.

The President said the matter had been pretty fully discussed, but one point had not been made very clear to his mind, and he thought it would be very advisable to have information upon it, which would perhaps be forthcoming at the next meeting—that was, as to the exact quantity of hydrochloric acid which was produced. Not only did they want to know the kind of condensation which had taken place, but they wanted to know how much muriatic acid had been obtained from a certain quantity of salt decomposed. That had not been very clearly stated by Mr. Jones, and probably, as he said, they had no data to make the calculation. But he hoped that at the next meeting Mr. Jones would be prepared to state how much hydrochloric acid was obtained from a certain amount of salt. Whether Henderson's process was likely to supersede all the others, and sweep the present plant

off the face of the earth they could not tell; but it was quite clear, he thought, that Messrs, Jones's furnace was a very great improvement on our present decomposing plant, and they ought to be very much obliged to those gentlemen for bringing before them such an important discovery. There was evidently a very material saving of labour and labour of a disagreeable kind, which was a very important consideration in these times. He had great pleasure in moving that a vote of thanks be given to Mr. Clapham for his paper, and to Mr. Jones and Mr. Walsh for attending there to give them the explanation of the working of their furnace.

CORRESPONDENCE.

ANALYSIS OF MANGANESE ORE.

To the Editor of the Chemical News.

SIR,—From his letter (CHEMICAL NEWS, vol. xxxiv., p. 19), I fear Dr. Phipson has not understood my query on the determination of the oxides of manganese, and I must therefore request the opportunity of explaining myself further. As Dr. Phipson is no novice I erroneously imagined that he would at once appreciate my meaning.

In the CHEMICAL NEWS (vol. xxxiii., p. 243) Dr. Phipson published in your columns a very elaborate analysis of a sample of manganese ore, which your contributor had found to contain 72·17 per cent of MnO_2. There was an additional quantity of manganese beyond the amount present in the above form, and this Dr. Phipson assumed to exist as Mn_2O_3, 6·20 per cent being thus accounted for.

In my last letter, I, in effect, asked if Dr. Phipson had any means of distinguishing this Mn_2O_3 from a mixture or combination in atomic proportions of MnO and MnO_2 ($=Mn_2O_3$), and I receive the unsatisfactory answer that Dr. Phipson "discovered the manganic oxide (Mn_2O_3) in a very simple manner, namely, by determining in the first place the total quantity of oxygen, and in the next the total quantity of manganese. These two data are quite sufficient for the purpose."

As well might Dr. Phipson attempt to distinguish acetate of ethyl from butyric acid (both of which have the same empirical formula) by determination of the carbon and hydrogen as think he can tell Mn_2O_3 from $MnO+MnO_2$ by merely ascertaining the proportion of manganese and oxygen, for a glance will show that the percentage composition is the same in each case.

Unfortunately, as a provincial chemist, the French edition of H. Rose's chemistry is not readily accessible, but I think the author would scarcely thank Dr. Phipson for fathering such a method on him.

My question was asked in perfect good faith, as I really thought there might be some means of arriving at the information sought. As it is I will ask your correspondent a few other questions, and challenge him to reply.

1. How does Dr. Phipson know that the 6·20 per cent of Mn_2O_3 which appears in his analysis was not made up of 3·41 of MnO_2 and 2·79 of MnO?

2. If he does *not* know, how did he distinguish the 3·41 per cent of MnO_2 from the 72·17 admitted to be present?

3. What process was employed for the determination of the main quantity of MnO_2, and would not the amount found include the 3·41 per cent, assuming the latter to have any existence?

4. If the result of the determination of the MnO_2 ($=72·17$) represents the *total* quantity of that oxide present, must not the remainder of the manganese necessarily have existed as MnO and not as $MnO+MnO_2$ ($=Mn_2O_3$)?

5. If the last question is answered in the affirmative, has not Dr. Phipson counted his oxygen twice over?—I am, &c.,

ALFRED H. ALLEN.

Sheffield, July 15, 1876.

DR. J. W. HEARDER, F.C.S.

To the Editor of the Chemical News.

SIR,—Mr. Mendola, in his attack on Dr. Hearder, has, I think, entirely mistaken his grounds. The letters F.C.S., F.R.S., or F. any other S., show and mean nothing whatever except that the holder is supposed to have some interest in the work of the said S., and that he is held in sufficient estimation by the members to be permitted to join them. I have not the smallest doubt that this is fully and perfectly understood in its proper sense by every person of very ordinary intelligence. What little position such a qualification as this gives is undoubtedly made use of one way or another by almost every member of every Society in existence. It may not be that every one sends it out by thousands, but even the leaders of the Chemical Society are not free from this fault, if it is a fault. To print it on the title-page of a book, or in fact anywhere else (except in matters strictly connected with the Society), is not appreciably different to printing it on a circular. It would appear that Mr. Mendola has an exalted idea of the possible value of the Fellowship of the Chemical Society. If a brass farthing is polished, and held at a respectful distance from the eyes of the public, perhaps some may mistake it for a sovereign; but I think to attempt to persuade the educated classes that the Fellowship of a Society is any qualification is an insult to their common sense neither Dr. Hearder nor Mr. Griffin would be guilty of. I am not aware that the Fellows of the Royal or any other Society attempt to hide their light under a bushel if it can be exhibited to their own moral or pecuniary advantage, and the same remark applies to the whole class of what may be called the Societies of Specialists. Men of business, of which a large proportion of the Chemical Society is composed, do their advertising in their own way; those who are not men of business simply do it in another way amongst their friends and acquaintances, and make, or think they make, a moral profit instead of a pecuniary one. When a Fellow of any Society makes it known that he is one, as a matter of business, he simply takes an indirect means of giving references to his personal friends who have signed his application,—*i.e.*, the fact of his being a member is, to a very limited extent, a moral guarantee that he is not absolutely unknown. If the Chemical Society transforms itself into a strictly professional Club, and goes out of business in the printing and publishing line except for its own members, then the use of the letters F.C.S. by the holder, except in matters strictly connected with the Society, might be considered improper.

It is an open question whether those who are raising the cry of discontent are not a few who—not being eligible or qualified for admission to the Royal Society—wish to polish their farthing up to the utmost limits, and try to make it look like the real thing. To my mind the only way to do this will be to admit all as Associates at first, and afterwards make the Fellowship conditional on the contribution of original papers or work to the Society. This revolution might include the whole of the existing Fellows who had not contributed any original work since their election. The rule might be that Associates should be elected as Fellows on the publication of any Paper of theirs in the *Transactions* after it had been accepted and read at one of the meetings. This would give the Fellows a slightly better position than they now hold, and would no doubt considerably increase the amount of original work published, more especially if all Fellows after their election were liable to be called on for Papers at intervals of say not less than one year. This would do what neither blackballing nor raising fees could do, and would be practically equivalent to an examination without its weak points. The position of the Society can be improved better without the use of personalities, and if the discussion of the matter is left entirely to the Council it will be better for all parties concerned. When discontented members descend to personal attacks in public journals,

the Society must be getting in a bad way, and it is time for the Council to take the matter in hand.—I am, &c.,

THOS. FLETCHER.

Warrington, July 18, 1876.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances, de l'Academie des Sciences. No. 26, June 26, 1876.

Maximum of the Possible Repulsive Power of the Solar Rays.—M. G. A. Hirn.—The attention of the scientific world has been latterly drawn to the singular phenomena which Mr. Crookes has studied with the radiometer. The conclusion which has presented itself to the mind of many is that these phenomena are due to an impulsive action of the luminous rays, and that it is thus demonstrated that light is a movement of ponderable matter. Nevertheless, the phenomena discovered by Mr. Crookes have been elucidated, if not in their cause, still in their form and their starting-point. The ingenious counter-proof to which M. Arthur Schuster has submitted them places it beyond doubt that it is by no means the direct action of the rays emanating from the luminous source which determines the movement of the discs of the radiometer, but that the repulsive power here called into play has its seat in the walls of the transparent vessel which serves to contain the mill, and that this power is set in action by the pencil of rays directed upon the apparatus. As the true explanation of the totality of the phenomena has not yet been given, and as the hypothesis of the materiality and of the impulsive force of light will probably not soon be abandoned, the author thinks it useful to submit this hypothesis to the test of the method of successive elimination. Mr. Crookes has calculated the apparent repulsion exerted by the solar rays at 1 grm. per square metre. This pressure is more than one thousand times greater than the maximum value possible for reflecting bodies, and more than two thousand times superior to the maximum value possible for absorbing bodies. We may, then, affirm that the phenomena which Mr. Crookes has made known are nowise due to the effect of an impulsion of light, and do not imply the idea of mass of density as regards radiant light and heat. However carefully the vacuum in the vessel enclosing the radiometer or torsion balance may be made, there remain, nevertheless, quantities of gas or vapour relatively enormous. The maximum pressure which the solar radiation can exert upon 1 square metre of absorbing surface is 0·0004157 grm.: let μs suppose that the discs of the radiometer are 10 square centimetres, the maximum pressure upon them will be 0·000004157 grm., or a little more than $\frac{1}{1000000}$th of 1 grm. The slightest agitation of the small quantity of gas remaining in the apparatus will produce upon the radiometer pressure comparable to this. However transparent may be the glass case of the radiometer, it still absorbs a part of the calorific or luminous rays; one of its surfaces is heated more rapidly than the other. This inequality of temperature necessarily determines electric polarity, or the manifestation of static electricity. The vacuum, it is said, is so perfect that the electric spark cannot traverse the apparatus. But electric attractions and repulsions traverse the vacuum. However feeble may be this cause of attraction and repulsion, it may nevertheless have a considerable value in comparison with our maximum of 0·000004157 grm.

New Experimental Considerations on the Radiometer of Mr. Crookes.—M. A. Ledieu.—The author's experiments become less and less favourable to the theory of the apparatus based upon the movements of gases and vapours remaining within the glass case after the vacuum has been made. This theory, as we know, is subdivided into various doctrines, of which a very complete and lucid exposition has been given by M. Bertin in the June number of the *Annales de Chimie et de Physique*. The capital objection which mechanicians oppose to these different explanations is, they are all reduced to admit, that the radiometer is an instrument of reaction. But in such apparatus, having regard to the impossibility of the motive power being rapidly produced with a sufficiently constant intensity, there ensue merely rotations accompanied by retardations and bounds far from being reconcilable with the perfect regularity of the radiometer. Moreover, the theory in question expressly requires that there shall never be an equilibrium of temperature between the gas in the case and the discs of the radiometer. But how are we to admit that in every experiment this equilibrium is not ultimately established? Moreover, the rotation ought to stop at last instead of maintaining itself indefinitely at the same speed. The author then cites certain experiments difficult to explain by the supposed movement of gases in the interior of the apparatus. Thus the instrument was heated nearly to redness, when it commenced turning, but the rotation was sensibly accelerated by the momentary presence of a single flame, which joined its action to that of the radiant heat. An apparatus was constructed with discs exclusively polished. On throwing a pencil of solar rays upon one of the two hemispheres of the glass case a perfect rotation was obtained, without interruption, and as free and rapid as with an ordinary radiometer fully exposed to the light. The author bases his explanation of the phenomena upon a mechanical action of the "ether" perpendicular to the direction of its rays of propagation, and not in the same direction as these rays. This interpretation is calculated to calm the legitimate disquiet of the partisans of undulation. In Germany there is a leaning to an explanation based upon electricity. They rely upon the experiment that when a radiometer with discs exclusively polished, and where one of the hemispheres of the case is traversed by a continuous electric spark, the instrument takes a rapid rotation always opposite to the direction of the spark, this direction being understood according to the common convention. "In any case the radiometer of Mr. Crookes seems to us a serious instrument, and not a paradoxical apparatus destined to enjoy an ephemeral scientific repute and then to rank as a mere physical amusement. Its experimental study, pursued under all modifications and with an indefatigable perseverance, will certainly lead to important results as to the mechanical properties of the ether."

Process for the Manufacture of Soda from Seaweed by Endosmotic Lixiviation.—M. L. Herland.—The author gives the following reasons for the depressed state of the seaweed industry: the weed is collected indiscriminately without regard to its greater or less richness in iodides or other useful salts. The weed destined for incineration is dried on the shore in the open air, whence results a decomposition and a loss of salts from the spray of the sea, dew, rain, &c. The process of incineration itself is the main cause of the weakness of the product in iodine, as a certain quantity is volatilised, but it is chiefly to the siliceous sand mixed with the weed that the great loss is due. In fact, silica at high temperatures reacts upon the iodides, producing alkaline-earthy silicates, and eliminating a certain quantity of iodine. The author, therefore, proposes the following method:—The fresh weed is placed in baskets of iron-wire, moved by a turning crane, and steeped in a series of vats containing about 50 kilos. of good quicklime per cubic metre of water, and arranged in circular batteries. The weed passes in succession from vat to vat, and is exhausted of all its useful salts. The same series of successive immersions is pursued with fresh weed until the first vat marks 4·3° to 4·5° on the hydrometer (pèse-sels, probably a Baumé's glass adapted for saline solutions). During this operation a double exchange takes place between the weed and the lime-water, by means of endosmosis. The time of steeping

is, on the average, from forty to sixty minutes. With a set of ten vats of 6 cubic metres it is possible to lixiviate in fifteen hours 50 tons of 1000 kilos. each of fresh weed. The second stage of the operation consists in evaporating to dryness the successive saturated lyes, and then calcining very slightly in presence of a slight excess of carbonate of potash, carrying the process to the commencement of the aqueous fusion. This procedure yields a soda very rich in soluble salts, in utilisable salts of potash (chloride and sulphate), and in alkaline iodides. The incineration process gives, on an average, 15 per cent of potash salts, and 1 per cent, at the outside, of iodide. The new process yields 45 to 50 per cent of utilisable salts of potash, and 2½, 3, or even 5 and 6 per cent of iodide if the weeds have been well selected. The residual weeds are still applicable in agriculture.

Certain Experiments made with the Balance of Crookes.—M. G. Salet.—The author makes the discs of his radiometer of mica, and blackens both on the same side. He considers his results difficult to reconcile with the idea of a direct impulse due to light or to the ether, but contrary to the theory which seeks to explain the movements of the radiometer by the disengagement of gases condensed on the discs. Can the minimum quantity of gas which remains in an apparatus exhausted with such care suffice to occasion the movement, according to Tait's theory?

Certain Derivatives of Normal Pyrotartaric Acid.—M. Reboul.—A description of the salts of zinc, copper, lead, silver, soda, and of the normal pyrotartrate of ethyl.

Volumetric Determination of Formic Acid.—MM. Portes and Ruyssen.—The authors remark that the quantitative determination of formic acid in acetic acid has a certain importance in solving the problem of the determination of wood-spirit in spirit of wine. They pour into a flask containing 5 grms. acetate of soda 25 c.c. of a solution at 10 per cent of the mixture in question, and add 200 c.c. of a solution of sublimate at 4·5 per cent (9 grms.). It is heated from one hour to an hour and a half in the water-bath until the supernatant liquid has become perfectly limpid. The whole is then made up to the volume of 500 c.c. and filtered. It is then ascertained, by means of a graduated burette, how much of the reduced liquid is required to saturate 1 grm. of potassium iodide. The number found by calculation must be corrected by the addition of one-fourth.

Arragonite observed on the Surface of a Meteorite.—J. Lawence Smith.—Arragonite has been found as an incrustation on certain specimens of meteoric iron from the so-called Mexican Desert (Bolson de Mapini), situate in the provinces of Cohahuila and Chihuahua. The author is of opinion that the incrustation has been formed since the fall of the meteorite.

Compounds of Carbon Found in Meteorites.—J. Lawrence Smith.—The author has pursued his studies on the crystalline hydrocarbides derived from terrestrial irons and doubtful meteorites, like that of Ovifak, searching for hydrocarbides in the carbon combined with these irons. That of Ovifak contains a notable proportion of this carbon. There was in these irons a substance similar to that already found in meteoric graphite and carboniferous meteorites. It has the same strong odour, and crystallises in small needles. If heated on platinum-foil it melts readily, and at higher temperatures it burns with a flame, and disappears.

Use of Calcium Chloride in Watering the Paths of Promenades and Public Gardens.—M. A. Houzeau.—The nature of this paper may be understood from its title.

Experimental Researches on the Action of Aniline Introduced into the Blood and the Stomach.—MM. V. Feltz and E. Ritter.—The authors describe the symptons produced, both in men and dogs, by small doses of magenta. It is fortunate for them that they are not resident in England.

A Differential Radiometer.—M. W. de Fonvielle.—The author has had constructed a radiometer, the discs of which (of mica) are coated on both sides with lampblack, and the case is blackened in the same manner over half its surface. If the light is received perpendicular to the diametral section which separates the transparent hemisphere from the darkened hemisphere the apparatus remains motionless. If, on the contrary, the diametric plane is inclined to the left, the left-hand discs, more strongly illuminated than those on the right, are repelled more energetically, and the radiometer takes a regular movement from left to right. The same phenomenon is observed in the inverse direction if the diametric plane is inclined to the right. The rotation is the most rapid possible when the diametric plane is rendered parallel to the rays of light which illuminate ths apparatus.

Researches on Cypressus Pyramidalis.—M. Hartsen.

Les Mondes, Revue Hebdomadaire des Sciences, No. 9, June 29, 1876.

The Radiometer of Mr. Crookes.—Since the commencement of the century much attention has been paid to the electric, magnetic, and mechanical action of light. The author in the third volume of his "Repertoire d'Optique" has analysed at length the experiments made by Sommerville, Barlocci, Valt, Zantedeschi, Matteucci, Faraday, Davy, Moleyns, &c. Valt alone (p. 1011) obtained under the action of light the orientation, if not the rotation, of suspended discs, all other attempts having led to negative results. If M. Récamier caused his discs to revolve under the influence of light under closed bells, it was certainly because he set in action gaseous currents. Mr. Crookes obtains indefinite rotations with extreme facility. His experiments, which constitute one of the most brilliant discoveries of the age, engage all minds, and are like an enigma on which no one has yet given the final decision. It is time for the Academy of Sciences to elect a commission to study these phenomena from all sides.

MISCELLANEOUS.

Death of Dr. Hearder.—The Plymouth correspondent of the *Pall Mall Gazette* telegraphs on the 17th inst.,—Dr. Jonathan Hearder died last evening from a sudden paralytic seizure. He was the last remaining of the group of men who made Plymouth famous for scientific discoveries forty years ago. Dr. Hearder's researches in science, especially in connection with electricity and chemistry, were not extensive, but profound. He had made his name well known among the leading physicists not only of England but Europe and America. Almost at the outset of his scientific career an accident befell him, which, in the case of a less determined lover of knowledge, would have put an end to reseach. While experimenting with a fulminating compound he was deprived of sight by an explosion. Yet his chief honours were won after that event. He was intimately associated with Sir William Snow in his electrical researches. His own discoveries and inventions in connection with the induction coil and the therapeutic appliance of electricity were many and valuable. Dr. Hearder was one of the earliest to perceive that a telegraphic cable across the Atlantic was not only important, but practicable, and he invented a cable for which he took out a patent, a slight modification of which was ultimately adopted for Atlantic telegraphing. Dr. Hearder had a marvellous memory, and was never at a loss for a fact or a date. He was a zealous lover of all matters connected with local antiquities and history. The bent of Dr. Hearder's mind was quite as practical as it was investigative. He invented special forms of stoves, gas and other, and was a specialist in the matter of fishing gear. He not only contrived medical electric apparatus, but practised as a medical electrician, and was electrician to the South Devon Hospital.

THE CHEMICAL NEWS.

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INFUSORIA AND NITRATES.

By T. L. PHIPSON, Ph.D., F.C.S., &c.

Some very interesting observations regarding the reduction of nitrates by bacteria have recently been made by M. Meusel. It has been long believed that the nitrites found in waters are due to the oxidation of ammonia, but the author just named has proved in a satisfactory manner that they are not necessarily so produced. Water containing no compound of nitrogen except some alkaline nitrate was found after a certain time to contain no nitrites: this reduction was the effect of numerous bacteria visible in the microscope. It was stopped at once by phenol, salicylic acid, benzoic acid, alum, and salt. The following experiment shows under what circumstances this phenomenon occurs:—

A little pure water, containing some bacteria, has an alkaline nitrate added to it. At first there is no reduction, but after the addition of certain organic substances, more especially carbohydrates, such as sugar, &c., nitrites are produced at once and rapidly. Recently distilled water, mixed with sugar and a little alkaline nitrate, then boiled in a long-necked flask, the end of which is closed during ebullition, showed no reduction after many weeks.

The conclusions drawn from these experiments are—That the nitrites found in ordinary waters are due to bacteria; that the latter are the agents of the transmission of oxygen, even when this substance is combined, and that this is probably the reason they are so dangerous to man.

On repeating these experiments with very dilute solutions of permanganate of potash, without the addition of any organic substance, I find the bacteria killed simultaneously with the reduction of the salt. I have also found that when a little too much nitrate of potash exists in the water no reduction takes place, and the bacteria are also rendered immovable.

Now M. Meusel has also asserted that nitrates are useful as manure, not only by the nitrogen they contain, but on account of the oxygen they supply to bacteria, which enables the latter to destroy cellulose, &c. If this is the case, it would appear, at first sight, that nitrate of soda would prove a more valuable manure than sulphate of ammonia. But not long since I applied sulphate of ammonia and nitrate of soda to two small plots of the same pasture land in such quantities as to supply *the same amount of nitrogen* in each case. 8¾ cwts. of nitrate of soda, and 6½ cwts. of sulphate of ammonia were used in this experiment, and the result was as nearly as possible identical in both cases. As with the bacteria, when either substance was applied in excess the grass was killed, and turned brown or yellow within three days. When applied in the most favourable proportions the yield in both cases was almost identical. Now 6½ cwts. of sulphate of ammonia supplied no available oxygen, whilst the 8¾ cwts. of nitrate of soda supplied about 1½ cwts. of oxygen, the quantity of nitrogen being the same. Yet there was no apparent result for this difference of oxygen.

Now, if M. Cloëz's theory is true, that C, H, and N are assimilated by plants as CO_2, HO, and NO_5, and that NH_3 in the soil or the manure becomes NO_5 to be assimilated, then the *atmosphere* would have supplied to the sulphate of ammonia the extra 1½ cwts. of oxygen in question. This, of course, would require rather more time, and such, in fact, was the case in my experiments, the nitrate being the quickest of the two by about eight days.

Laboratory of Analytical Chemistry,
Putney, London, S.W.

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 26.)

Chlorine, Bromine, Iodine, and Fluorine.

By Dr. E. Mylius, of Ludwigshafen.

Regeneration of Manganese according to Weldon.—Recently Weldon has completely succeeded in attaining the object aimed at by so many. C. Binks and J. Macquent had previously sought to revivify the chloride by precipitating it with the quantity of hot milk of lime needful for decomposition, passing a current of hot air through the liquid, and utilising the precipitate thus converted into higher oxides in place of fresh manganese. But Weldon was the first who succeeded in making the process technically applicable. His most essential improvement consists in the point that he uses not a sufficient quantity of milk of lime, but an excess. Considering the importance which Weldon's process for the regeneration of manganese has already attained in the modern manufacture of chlorine, since its commercial value is fully proved by its introduction in many establishments, especially in England, it may be considered permissible to describe its principles at greater length than the procedures already mentioned. The following account is founded partly on Mr. Weldon's paper in the Chemical News (vol. xxii., p. 145), and partly on his letter to Dr. A. W. Hofmann, dated March 12th, 1874.

Whilst, according to Weldon, hydrated manganous oxide diffused in water can be only oxidised to manganic oxide, Mn_2O_3, by forcing oxygen through the paste, it is possible, in the presence of lime or magnesia in excess, to convert the whole of the manganese into peroxide. The latter remains united with the lime as a compound, CaO,MnO_2, or $CaMnO_3$, calcium manganite. This may be regarded either as an analogue of the hydrated peroxide of manganese, or as manganic oxide, Mn_2O_3, in which an atom of manganese is replaced by lime. Hence it follows that 1 mol. calcium manganite requires exactly as much hydrochloric acid in the preparation of chlorine as 1 mol. of Mn_2O_3. Nevertheless it is advantageous to oxidise the manganous oxide with the aid of lime, since, in the first place, the same amount of manganese performs double the duty as if it had been only converted into manganic oxide; and, secondly, the oxidation is effected with far greater ease in presence of an excess of lime. This is probably because manganous oxide is somewhat soluble in pure water or in solution of calcium chloride, and thus retards the oxidation. At least it has been experimentally proved that salts of manganese decidedly retard the progress of oxidation. If, on the other hand, there is an excess of lime, a brown solution of calcium manganite is rapidly formed, which, as experiments prove, greatly accelerates the absorption of oxygen by the deposit of manganous oxide.

Latterly, however, it has been found possible to complete the oxidation of the manganese by an increased current of air along with a diminished dose of lime. Under these circumstances we may assume the formation of an acid manganite, $CaMnO_3,H_2MnO_3$. In fact, in exceptionally successful operations, calcium manganite has been obtained in which only 1 mol. of lime was present to 2 mols. of peroxide of manganese. In most cases the manganese paste has the following composition:—

0·80 = MnO_2,
0·20 = MnO,
0·28 = CaO.

* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzenends."

† *Technologiste*, 1862, Sept. 27. *Wagner, Jahresberichte*, 1862, 237.

That the lime in the paste is chemically combined, and does not exist as a mere admixture, may be inferred because the product is perfectly neutral, and because lime cannot be withdrawn from it by a solution of sugar. The manganous oxide can also be oxidised by air when the lime is replaced by baryta, strontia, or soda.

On a practical scale the process is carried out as follows:—The manganese liquor from the chlorine stills is let off into tanks provided with agitators. In these it is treated with finely-divided carbonate of lime, to neutralise the free acid and to throw down any iron which may be present as oxide. The liquid is then pumped off into settling-vats, in which it is left to become clear. Hence the clear neutral solution is run into the oxidiser—an iron cylinder, 3·66 metres in diameter and 6·61 in height. Into this, near the bottom, opens a narrow pipe which conveys steam, and one or more wider air-pipes. After the liquid has been heated to 55°—75° by a current of steam, milk of lime, prepared from finely-sifted hydrate of lime, is run in as rapidly as possible, whilst air is simultaneously forced in until no manganese can be detected in the filtrate. This occurs when not only all the manganese is converted into manganous oxide, but when an excess of hydrate of lime is already present. For this purpose 1·15 to 1·45 mols. lime are required to 1 mol. manganese.

(To be continued.)

ERYTHROGEN AND SOME OF ITS COMPOUNDS.

By LEWIS THOMPSON.

WHEN we look at the vast extent of our gas-making industry, and the number of persons interested in keeping up an artificial cry about the "sulphur in gas," we may well wonder that so little has yet been done to remove the exaggerated defect. But this display of inventive poverty is not altogether without its value, for it teaches us, beyond the possibility of doubt, that Governmental interference with any manufacturing industry is not a rapid road to improvement.

About twenty-nine years ago I first became aware of the fact that such articles as liquor ammonia and carbonate of ammonia, when made direct from gas-liquor, always contained more or less of a peculiar red substance, which contaminated the ammoniacal products, and rendered them unfit for use in silk dyeing and some other arts; and a careful examination convinced me that this red matter was not sulphocyanide of iron, but had some mysterious connection with bisulphuret of carbon. I have often separated this red matter from gas-liquor, and also from gas-lime refuse, and both shown and given it to several of my friends, but it has always been so mixed with other impurities that no decisive opinion could be formed regarding it, except the mysterious connection above alluded to. The mystery, however, appears to admit of solution if we suppose the bisulphuret of carbon to be a halogen body like cyanogen, and therefore capable of uniting directly with metals; a supposition which I have carried out into practice by combining it to potassium, with which it forms a compound remarkable for the blood-red colour of its solutions in water and alcohol, and therefore I propose to give the name Erythrogen (from "Erythros," red) to the bisulphuret of carbon in its combinations, and Hydro-Erythric Acid to the acid set free from the solution of the erythride of potassium by an acid.

Not to trouble your readers with any superfluous remarks, I will describe in as few words as possible the mode of making the erythride of potassium, from which the hydro-erythric acid and other compounds may be produced by the usual chemical processes.

To make erythride of potassium, we must begin by making an amalgam of potassium, consisting of about 1 part by weight of potassium and 150 of mercury, which is easily done by fusing them together under naphtha. When cold pour off the naphtha, and having wiped the surface of the amalgam with a dry cloth, transfer it as quickly as possible to a dry stoppered bottle, and add to it a quantity of bisulphuret of carbon equal to about three times the weight of the potassium employed; then shake the whole well together until the mixture becomes solid, when it must be set aside for a few hours to cool and complete the combination. After this, the surplus bisulphuret of carbon is to be driven off by a current of air, and the erythride of potassium separated from the mercury by water and filtration in the usual way. But it is worthy of notice that a part of the mercury, under the influence of the potassium, is converted into erythride of mercury at the same time, and this holds out a hope that such metals as lead and antimony in a very minute state of subdivision may be useful in purifying coal-gas from bisulphuret of carbon; and, in fact, I am now actually trying the pyrophoric mixture of lead and charcoal formed by heating the tartrate of lead, and it seems to promise well. When the hydro-erythric acid is thrown down by acids from the solution of erythride of potassium, much of it is decomposed in carbonic acid and sulphuretted hydrogen, except at a very low temperature; but in either case it forms a fixed, chocolate-red, granular powder, most remarkably like selenium.

Sandy, Bedfordshire, July 22, 1876.

ON THE AMALGAMATION OF IRON AND OF SOME OTHER METALS.*

By P. CASAMAJOR.

AT the last meeting of this Society I was to speak to you on amalgation of iron, but was prevented by the lateness of the hour from reading the paper I had ready for you. Since that evening I have learned a great many things about iron amalgam, one of which is that most of the processes that I was to describe had already been published, although in a very succinct form, about nineteen years ago. This discovery would have prevented me from appearing before you to-night if I had not found that the subject is deemed by chemists, to whom I have shown samples of amalgamated iron, to be not only new, but very interesting. I have, besides, much new matter to communicate, among which is a new process for amalgamating iron, which is so simple and economical that all the other processes are rendered obsolete and useless.

That iron will combine with mercury is known to all chemists, although it is not deemed an easy operation, and we may find in the books several processes for accomplishing the combination. One of these, which I believe is due to Sir Humphry Davy, consists in immersing sodium amalgam in a saturated solution of ferrous chloride or sulphate. In another process zinc amalgam is brought in contact with iron filings, in presence of a solution of ferric chloride. The filings become coated with mercury. In still another process, the electrolysis of ferrous sulphate gives iron amalgam when the negative electrode is formed of mercury. By subjecting the resulting amalgam to enormous pressures a residuum of pretty firm consistency is obtained, which is composed of about equal parts of iron and mercury.

The processes of amalgamation which I am to describe to you this evening give products which have nothing in common with these iron amalgams. The samples of iron amalgam, such as I have here, are obtained from commercial wrought-iron, from cast-iron, and from steel, without altering the original shape of the material, as it are analogous to the amalgam made from commercial zinc which we use in voltaic batteries.

Before giving you the results of my labours I must give you a succinct account of the researches of Cailletet,

* Read before the American Chemical Society, June 1st, 187 Communicated by the Author.

which came to my knowledge as follows:—Before presenting myself before you at the last regular meeting it had been my endeavour to ascertain whether the results I was to announce were really new. Neither by my own exertions nor by inquiry from other chemists had I been able to discover that I had been forestalled, and had I confined my attention to iron I would not have been aware—perhaps even now—of the existence of a prior claimant.

Having turned my attention to aluminium, I had occasion to consult Watts's "Dictionary of Chemistry," on the subject of aluminium amalgam, and came upon the following:—"According to Cailletet (*Comptes Rendus*, vol. xliv., p. 1250, aluminium (also iron and platinum) may be superficially amalgamated by contact with ammonium or sodium amalgam and water; also when it is immersed in acidulated water in contact with metallic mercury, forming the negative electrode of a voltaic battery."

On consulting the 44th volume of the *Comptes Rendus* I found, at p. 1250, a memoir presented to the Academy of Sciences by Messrs. Chevreul and Dumas, at the sitting of June 15th, 1857, the title of which is "On the Influence of Nascent Hydrogen on Amalgamation," by M. L. Cailletet. The author uses ammonium amalgam, with which he agitates pieces of iron, aluminium, or platinum, and he finds that these metals become coated with mercury. The amalgam of sodium produces the same effect, only water is necessary to the reaction. If the surface of the sodium amalgam is covered with naphtha no action takes place, but one drop of water is sufficient to produce the desired effect.

If in a vessel containing mercury and acidulated water we place the electrodes of a battery, and if the negative electrode be a piece of sheet iron in contact with mercury, the iron will be amalgamated as soon as hydrogen appears on this electrode.

From these experiments Cailletet concludes that amalgamation in these cases is due to nascent hydrogen, and he seems throughout his memoir to be so intent upon proving this point that every other circumstance is mentioned in the most cursory manner. We may be allowed to doubt whether by covering sodium amalgam with naphtha, so that when iron comes in contact with the amalgam it is already covered with a film of naphtha, we have placed the iron in the best condition to combine it with mercury, and whether the non-combination under these circumstances is very conclusive of the necessity of nascent hydrogen to determine the combination between iron and mercury.

The following experiment with a mercuric salt carries more weight with it:—The author wishes to show that amalgamation, in the case of iron and platinum, is due to nascent hydrogen, and not to the electrical condition of the iron or platinum electrode. He takes the case of the electrolysis of salts of copper, silver, and mercury, and recalls that at the negative electrode we obtain metallic copper, silver, and mercury, but no hydrogen. If we have a salt of mercury subjected to a voltaic current, the negative electrode being made of iron or platinum, we may notice after a while that globules of mercury appear on this electrode, but they show no tendency to combine with it. If, now, the electrodes are withdrawn from the mercury salt, and placed in a vessel holding acidulated water, as soon as the voltaic current passes and hydrogen escapes at the negative electrode the globules of mercury spread on this electrode, and it becomes amalgamated.

The above account of the memoir presented by Cailletet contains substantially everything there is in it. The circumstance mentioned in "Watts's Dictionary," that the amalgamation obtained on iron and platinum is merely superficial, does not appear, even by implication, in the original paper.

Amalgam of sodium and ammonium, and the voltaic battery: these are the agents mentioned by Cailletet; these were also the agents that I used a month ago to determine the combination of iron with mercury. Although I now use a much simpler and a cheaper process, which I propose to describe in a few minutes, there are some points in connection with the alkaline amalgams and with the action of the voltaic current which may be studied with advantage.

Amalgam of potassium, which I first used for amalgamating iron, behaves in every way like amalgam of sodium. Sodium, however, behaves somewhat differently from potassium towards mercury, the combination with sodium taking place with greater violence, being accompanied by a flash of sodium light and the escape of alkaline vapours which are far from agreeable. These unpleasant manifestations may be reduced to a minimum by combining sodium at first with a very small quantity of mercury—a quantity not more than a fifth of the weight of the sodium. This gives rise to a violent reaction, but subsequent additions of mercury produce less and less effect, while, by bringing small pieces of sodium successively into a comparatively large mass of mercury, every fresh piece of sodium produces the same effect as its predecessor.

If the sodium amalgam has sodium enough in it to make it pasty, it will cover iron with a silvery coat. This coat may be rubbed off, leaving the oxidised surface unaltered. If brought in contact with water, or, still better, with a solution of sal-ammoniac, the sodium amalgam is decomposed and the mercury will sink into the iron. If the sodium amalgam is liquid it will adhere in little drops all over the surface of a piece of iron shaken up in it; by the action of water, of acids, or of sal-ammoniac, the droplets will spread on the iron, which will become amalgamated.

Ammonium amalgam will give up its mercury to iron when rubbed up with it very persistently. Even then there are in every piece of iron certain spots where the mercury will not adhere. The intervention of acidulated water, by decomposing ammonium amalgam with great energy, facilitates the amalgamation of iron in these difficult portions.

From the foregoing remarks you will understand that the maximum of good effect may be obtained from a certain amount of sodium by the following method of procedure, while the combination of iron with mercury is very thorough and rapid:—We take four porcelain dishes and place them in a row, so that the piece of iron to be amalgamated may be placed successively in each. The first dish contains a liquid sodium amalgam; the second a solution of sal-ammoniac; the third water, acidulated with either sulphuric or hydrochloric acid; and the fourth aqueduct water. The piece of iron to be amalgamated is taken up with tongs, and agitated in contact with the sodium amalgam of the first dish. This operation covers it with liquid mercury containing sodium amalgam. When the surface seems sufficiently coated the iron is left for a few seconds in the solution of sal-ammoniac, on emerging from which it is found covered with the curious and interesting compound which we call ammonium amalgam. The piece of iron is placed next in the acidulated water, and finally in aqueduct water, to wash off the acid.

This series of operations is generally sufficient to leave a good coat of mercury on a piece of iron. If there should be spots left bare, a second series of immersions is generally sufficient to leave the surface perfectly covered. I need not say that the surface of the iron must be previously made clean by immersion in diluted acid.

By making the negative electrode of a voltaic battery of iron, and placing it in contact with mercury and with acidulated water, the iron will, after a time, become amalgamated. I have obtained the same result by a single voltaic element, the positive plate of which is a piece of zinc and the negative plate a piece of iron, one portion of which is in contact with mercury at the bottom of the cup, the exciting fluid being acidulated water. An addition of chloride of sodium to the liquid in the cup seems to hasten the reaction.

Iron may be amalgamated also by the use of zinc amalgam. This process gives the best results, and renders superfluous all the other processes we have mentioned. The use of zinc amalgam for the purpose had been attempted before, as, for instance, in the process I have mentioned where iron filings are rubbed with zinc amalgam in presence of a solution of ferric chloride, the reaction being assisted by heat. I also find in "Watts's Dictionary" that, "according to Aikin, iron amalgam is formed by the action of zinc amalgam on ferrous chloride." No particulars are given about this process, but the results must have been, to say the least, difficult to obtain, as we find, immediately af er that, "according to Damour, it cannot be obtained in this way."

I came upon the process I am about to describe by a mere chance. I was trying to test the soundness of the theory of Cailletet, which attributes the amalgamation of iron to the presence of nascent hydrogen. In a beaker glass I had placed mercury, and over it acidulated water, and also a horse-shoe nail of Norway iron, which rested on the mercury. A moderate escape of hydrogen took place from the surface of the iron nail; but after twenty-four hours no trace of amalgamation had appeared, which showed very conclusively that unassisted nascent hydrogen was certainly not sufficient to do the work. Having to amalgamate a small piece of zinc for another experiment, I found that I had no other mercury within my reach than the one on which the nail of Norway iron rested. As I had given up hopes of accomplishing anything by this arrangement, I had no scruple to use the mercury in this beaker glass, and in it I placed my piece of zinc: the result was that the escape of hydrogen from the nail increased very perceptibly, which circumstance induced me to leave the zinc in the mercury. On looking again at the iron nail I found it amalgamated and partly sunk into the mercury.

To amalgamate iron with zinc amalgam, mercury should be placed in a vessel and covered with dilute sulphuric or hydrochloric acid. If, now, a piece of iron is agitated, in contact with the mercury and the acid, no combination will take place; but if pieces of zinc are placed in the mercury, in a few minutes iron placed in the above conditions will become coated with mercury. If after a while the power of the mercury seems to decline, more zinc must be added. The zinc is only attacked when iron, or some other metal more electro-negative than zinc, is brought in contact with the zinc amalgam and the acid, so that the expense in zinc is very slight.

The coat of mercury left on iron by the various agencies I have mentioned is not a superficial layer, for the mercury sinks into the metal, modifying its physical and chemical properties. In the case of pure soft iron it is difficult to notice any decrease of tenacity after amalgamation. With hard-tempered steel, however, the increased brittleness is very marked. In the case both of iron and steel a fresh fracture shows that mercury has penetrated deeply into the metal.

Of the chemical change operated on iron by amalgamation I can call attention to only one point, which is the analogy which exists with the properties of zinc amalgam. When a piece of zinc* has been amalgamated it is not attacked by acids as readily as zinc free from mercury; but if a piece of amalgamated zinc is connected to a piece not amalgamated, the amalgamated zinc becomes the positive plate in a voltaic couple. These properties of amalgamated zinc are found, although in a less degree, in amalgamated iron. Two pieces of sheet iron, presenting exactly the same surface, were placed in diluted sulphuric acid, so that the action of the acid was exactly the same on each. One of these plates was amalgamated, the other not. After prolonging the action for over two hours, it was found that the amalgamated plate had lost two-thirds as much in weight as the other.

If, however, two pieces of iron*—one amalgamated and the other not—are connected by a metallic wire, the amalgamated plate is attacked, and the other plate plays the part of a negative.

In iron amalgam, made in the way I have described, the quantity of mercury in combination is very small. A piece of sheet iron, presenting on both sides a total surface of 3 square inches, was amalgamated and left to soak in mercury for over an hour. The mercury was then wiped off very thoroughly, and the piece of sheet-iron weighed. The increase over the original weight was 13 centigrammes, which showed an absorption of mercury equal to a little over 4 centigrammes per square inch. The increase of weight in this thin sheet of iron was only 3½ per cent. Still in this sheet the fracture was silvery, and globules of mercury stood on the rough edge of the fracture.

For the sake of comparison I treated a piece of sheet zinc, of the same dimensions, in the same manner, leaving it, however, only a few minutes in contact with mercury. After rubbing off the excess of mercury, and weighing, I was surprised to find a loss instead of a gain in weight. This was doubtless due to a certain quantity of zinc being dissolved by the mercury.

I must now, to fulfil the programme offered by the title of this paper, speak to you of the amalgamation of some other metals, by which are meant some of those whose point of fusion is very high, and which have always shown themselves exceedingly adverse to combining with mercury. Those that I have tried are platinum, palladium, aluminium, nickel, and cobalt. Except in the case of aluminium there seems nothing of peculiar interest to notice about their amalgams, after what has been said of iron amalgam. These metals all take mercury very readily by the processes which are effective in the case of iron. Aluminium deserves mention on account of its eccentric behaviour: it seems to take mercury in the same manner as the other metals, but shortly after being taken out and dried it becomes very hot, the mercury seems to boil, and the aluminium remains covered with a chalky crust. On brushing this off, the metal is found beneath without a sign of amalgamation.

In conclusion, I will point out that two inquiries suggest themselves in connection with these amalgams. One relates to the determining cause of these combinations, and the other is whether these amalgams—particularly amalgam of iron—can be applied to useful purposes. To both these questions the answer is, that I have nothing satisfactory to offer, although great many things suggest themselves as plausible. I am sure you will readily excuse me from presenting theories that are merely plausible, as to the cause of these phenomena, and feel equally certain that I need offer no apology to this enlightened auditory for calling their attention to these combinations of mercury with iron and other metals, because these have not yet become of practical utility, although it may be befitting to offer an apology for the manner in which the task has been performed.

* This observation relates to impure zinc. Amalgamation makes impure zinc behave towards acids like pure zinc.

* This is more easily noticed with steel than with pure soft iron.

ON MEASURING AIR IN MINES.†

By JOSEPH DICKINSON, F.G.S.,
H.M. Inspector of Mines.

(Concluded from p. 27.)

† A Paper read before the Manchester Geological Society.

With such a wide choice of anemometers, let it not however, be supposed that there is no difficulty in ascertaining the true average velocity of some air currents. It is only when the current is regular that implicit reliance may be placed upon such instruments. In an intermitting current the pulsations are shown plainly enough by either the counterpoised fan-plate of the Dickinson anemometer or the pendant of other similar instruments, and

in reading off the velocity from such the average of the vibrations must be taken. But with the windmill anemometers the altered speeds are more difficult to detect, and they are also accompanied by the serious defect that when the intermittence is great the number of revolutions recorded are so largely in excess as to be practically useless, owing to the momentum which the wheel attains, when the current is quick, carrying it (especially when the wheel is a heavy one) with but slightly lessened speed through the periods when the current is slow.

This exaggeration of the revolutions of wheel anemometers in intermitting currents may be readily proved, either by watching the instrument when blown upon in puffs, or by passing it intermittingly over any given distance in a still atmosphere. It may also be proved by placing the instrument in an intermitting current, when the actual average velocity can be accurately known, as in those cases where the total quantity of air passing is known by having to pass through an air-pump of certain dimensions, and making a certain number of strokes per minute. When furnaces or fans are used as the ventilating power, the intermittence is generally not of much importance, except when air doors are opened and such like, or when firing up the furnace, or if there be some irregularity in the construction or working of the fan. But with a single air-pump, worked with one piston, or if there be two pumps and two pistons, but changing stroke at the same time, the effect upon the anemometer, caused by the intermitting current, is such that the revolutions are enormously increased. The intermittence is even perceptible, and affects the anemometer when there are two pumps, one of which changes stroke when the other is at half stroke, but this greatly lessens the injurious effect, and the current is comparatively steady.

Similarly exaggerated results also occur with the windmill anemometers when they are changed about at short intervals, as is not uncommon, in endeavouring to get an average velocity of the current in the various parts of the space where the observation is being taken. In these instances the momentum attained in the quick part of the current carries the wheel round at a higher velocity than it would have attained in those parts where the current is slow.

Inaccuracy in this latter respect may, however, be avoided by having separate anemometers placed at the same time in each part of the airway space where the velocity varies, and averaging the results. When, however, only one anemometer is used for measuring a current which varies at different parts of the space where the velocity is being taken, the anemometer should either be held for a long time in each part of the space, so as to minimise the effect caused by the momentum of the wheel, or a separate measurement should be made of the respective velocities, and an average taken of the results. But in this way it will have to be assumed that the current continued uniform whilst the respective observations were being taken, which perhaps may not have been the fact.

The space occupied by the operator's body in using any anemometer, especially in small airways, or if the instrument be not properly faced to the current, may also, obviously, render the result inaccurate.

It is also essential in using windmill anemometers to ascertain the proportion existing in each instrument between the number of revolutions and the velocity of the air-current. In M. Combes's treatise, previously named, the whirling machine by which he made experiments to find this correction is described. I had an opportunity of seeing this whirling machine at the instrument maker's (M. Newman, I think) when in Paris, in 1853. It consisted simply of a balanced rod, on one end of which the anemometer was placed, and being held overhead by one hand and twirled round on a spindle by the other hand. By taking a series of observations at different speeds over certain linear distances, in a still atmosphere, and comparing the number of revolutions which the anemometer recorded with the linear distance which it had travelled, the coefficient numbers for correction were deduced. This form for correction M. Combes put into an equation, namely :—

$$v = a \times n + b$$

n being the number of revolutions indicated by the anemometer, and a and b are two coefficient constant numbers determined by the series of experiments, and v the true velocity of the air. This formula is still used, except that other letters are now more common.

This whirling machine of M. Combes was probably the first of the kind. On seeing it, I saw at once that the principle was good, but that the mode of carrying it into practice might be improved; and having described it to Mr. Casartelli, of Manchester, he constructed an improved machine, which was fixed on the floor, and with a whirling circle of about 25 feet in circumference, that of M. Combes being much smaller. Improving upon this some time afterwards, Mr. John Daglish, then viewer at the Hetton Colliery, in Durham, in conjunction, I think, with Mr. Lindsay Wood, adapted to a machine, on the same principle, a weight by which steady velocity was given, the speeds being varied according to the increased or decreased weight attached at one time. And this is the whirling machine now used by instrument makers for setting the scale on the quadrant of the Dickinson anemometer, and for ascertaining the correction for bringing revolutions into velocities with the windmill anemometers. When, however, a standard anemometer of either kind has been obtained, it may be used for setting and testing other anemometers by, provided that the two be carefully experimented upon together in the same currents of air.

Instead of using the formula for deducing the velocity from the revolutions of windmill anemometers, the correction is now frequently, and indeed more readily, made simply by adding a number, which, by, testing, as previously described, is found applicable to the particular instrument at different velocities. Thus, if it requires a current of say 50 feet per minute before the wheel begins to revolve, it would require an addition of that number to ascertain the velocity of the air when the anemometer just begins to move, and so on, varying with the respective velocities and instruments. For making the correction in this way, the numbers to be added are sometimes given in a tabular form, and sometimes in the form of a diagram, from which the number has to be measured by a scale. The correction, as before stated, varies with each anemometer; but with Biram anemometers of like construction, and registering revolutions without any attempted correction in the instrument, the required addition for correction does not vary much, and it would appear that, with instruments so constructed, the correcting number to be added diminishes as the velocity increases, the number being often small when the revolutions exceed 400 per minute. The ratio of correction appearing, generally, like the asymptote of the hyperbola, always approaching, but never meeting.

From these sources of error in the measurement of air currents in mines many mistakes have apparently been made in the amounts of ventilation, and when the result has been used for determining the amount of power utilised by ventilating machines, the percentage has been greatly exaggerated.

For comparative observations of the ventilation made from time to time in a mine, the surest way is to place the same anemometer on the same spot, and under the same circumstances, on each occasion relying upon revolutions and not velocity.

But for ascertaining the actual quantity of air passing in a mine when the current is intermitting—so difficult, indeed almost insurmountable, is the process with an anemometer—that, where open lights are allowed, it seems preferable (although it has been called a barbarous way) to resort to the old rough and ready ways, by the smoke of gunpowder or tobacco, or by the flame of a

candle, as previously described; and where gunpowder smoking, and open lights are prohibited, a small balloon filled with gas, to float in the air and bound about from roof to floor and side to side, as carried by the air current, is a good substitute.

For steady currents, however, there is nothing so good as an anemometer. The candle cannot be carried with the average of the whole current, and the smoke of powder or tobacco is found to hang where the current is slow, making it at times uncertain what portion of the arrival should be taken as indicating the average.

Similarly erroneous computations of the percentage of power utilised by ventilating machines have likewise been made, when, in intermitting currents, the pressure of air (which is one factor in the calculation) has been taken by the common inverted glass syphon water-gauge. Notwithstanding that in nearly all such gauges the tube is usually contracted at the bend, the water dances up and down so that it is impossible to read off accurately the average distance between the two surfaces.

The want of a compensating water-gauge for measuring the pressure of intermitting currents first presented itself to me in the year 1861, when measuring the amount of power utilised by the Struvé air pumps. On that occasion, finding it impossible to obtain any reliable measure of the average pressure of air by the ordinary water-gauge, my colleagues, Mr. Thomas Evans and the late Mr. John Job Atkinson, and myself, used two ordinary buckets of water, one bucket being placed outside and the other in the return air, the water in each being connected by an india-rubber tube. This method served the purpose, but as the buckets widened towards the top, the area of the surface of water in each was not equal, and consequently the depression of water in one did not correspond exactly with the elevation in the other, which made it requisite to measure the height it rose in one and the depth it fell in the other, and to add the two together in order to obtain the total pressure. A readier mode than the buckets of water, as might be expected, soon occurred to us, and in the same year I had a proper compensating water-gauge, made by Mr. Casartelli, of Manchester, (the one shown to the meeting) by which, no matter how intermitting the current, an accurate measure of the pressure may be readily taken, by having the two limbs for the water so large and the connecting aperture at the bottom so small that the flow of water does not sensibly affect the level during the pulsations. The gauge consists of a brass box, divided by a thin partition into two chambers, with glass front, and with the aperture at the bottom connecting the water in the two chambers regulated by a tap. The full size of the gauge is 6 inches high, 4 inches broad, and 3 inches wide; the 4 inches in breadth being divided by the partition, making the two chambers each 2 by 3 by 6 inches. The tap for regulating the flow of water between the two chambers is worked outside, underneath the bottom of the gauge. At the top of one of the chambers there is an opening 1 inch in area to admit the pressure of air on that side, and at the top of the other chamber there is a brass nozzle for inserting through an augur hole to admit the pressure of air at the other side. There is also a tap on this nozzle for closing when required. At each side of the glass front, and also down the middle of it in front of the partition dividing the two chambers, there are scales graduated into inches and tenths, so that the difference between the level of the water in the two chambers may be accurately seen. Mr. Atkinson soon afterwards had also a gauge of the same kind made for himself, but his had a pipe which came outside for connecting the two chambers at the bottom, instead of a tap regulating the size of a hole in the partition, as in mine. These two compensating water-gauges were probably the first of the kind used in this country; but on afterwards using them in testing some of the ventilating machines in Belgium, we were informed that similar gauges had been previously used by the ingenious mining engineers in that country.

NOTICES OF BOOKS.

Analysts' Annual Note-Book, 1875. Edited by Sidney W. Rich. London: Published for the Author.

This book, as its title implies, consists of a selection of analytical methods which have appeared during the past year. The name of the author is given in every case, but there is, in most instances at least, nothing to indicate whether the various papers are reprints from scientific journals and from the Transactions of societies, or whether they have been originally communicated to the "Analysts' Annual Note-Book." We cannot help suggesting that in future issues of this note-book the editor would do well to conform to the custom of indicating the source as well as the authorship of his extracts. We must likewise insist on the danger of abridging the descriptions of analytical processes. To take an instance: in MM. Champion and Pellet's method for determining glucose in presence of sugar Mr. Rich tells us to "collect and wash the suboxide (copper) formed, place the filter, still damp, in a capsule, and add dilute hydrochloric acid, which converts the suboxide of copper into sub-chloride. The liquid becomes coloured and the copper passes into the state of bichloride of copper of a greenish yellow colour when it is titrated with chloride of tin." But if we refer to the *Comptes Rendus*, No. 3, Jan. 18, 1875, or, in default, the Chemical News, vol. xxxi., p. 84, we shall find that the liquid in question is to be "raised to a boil, adding by degrees some crystals of chlorate of potash," by the action of which the conversion of the sub-chloride of copper into the bichloride is effected. If, as we doubt not, Mr. Rich wishes to render his note-book really useful to analysts, he will agree with us that every step in a novel analytical method should be fully described.

A great part of the matter given relates to the adulteration of food and drugs, and must have already come under the notice of the majority of chemists in this country. The fact that certain impure ammonia turns a "gooseberry red colour" on admixture with nitric acid is not a recent observation. To our certain knowledge it was utilised as a test in dye-works, &c., in the North of England eight years ago.

Seventh Annual Report of the State Board of Health of Massachusetts; January, 1876. Boston: Wright and Potter.

We have here a most elaborate report on the sanitary condition of the State of Massachusetts. The condition of the rivers, the sources of pollution, the water supply for domestic and manufacturing uses, the sewerage of the towns and villages, and the disposal of the sewage are all fully described.

On the subject of the "Disposal of Sewage" there is a special paper by Dr. C. F. Folsom, in which the past experience of the principal European countries is described. Such a treatise would have been exceedingly useful had the author taken the trouble to ascertain the truth. Instead of so doing he accepts and retails a number of the statements which English sewage irrigationists have repeated till they believe them. As an instance of the glaring errors with which this essay abounds we turn to the account of the sewage treatment at Leeds. We are told that the authorities there tried several of the precipitating processes one after the other, "finding them all failures." This is incorrect; two, if not three, of the processes tried have been found successful, and one of these has been selected as most completely answering all the conditions required of a sewage process. The deposit is not, as Dr. Folsom has been informed, "quite offensive" whilst drying. The tanks are not made of iron, but of masonry; they are not six in number, but twelve they are not cleaned out when the deposit becomes a foot deep—which is never the case in those farthest from the infall—but *pro re natâ*. The effluent when the opera-

tion is fairly worked does not "soon putrefy." The manure, instead of being unable to find a sale at two shillings a ton, is contracted for a twelvemonth in advance at twelve. What confidence can be placed in an author who heaps up inaccuracy upon inaccuracy in such a manner, and what must we think of his informants? One truthful confession, however, somewhat redeems this imaginative description of the Leeds Sewage Works. The author admits the absence of offensive smell. Here he contradicts one of the most preposterous assertions of the Rivers' Pollution Commission that "bad smells are always perceptible." What he admits further negatives another of their baseless statements, that "the process produces no clearer water than what would have resulted if the sewage were allowed to settle by itself." It so happens that this point has been experimentally decided at Leeds. Some years ago, we do not know whether, in consequence of the assertion quoted by Dr. Folsom—a tank at the Old Works was filled with sewage and allowed to settle. The result was not a clear, colourless, inodorous liquid like that attainable by precipitation, but a nuisance which no one could approach without feeling nauseated.

Speaking of Leamington the author declares that "in 1870 the authorities of this town, having proved the precipitation processes to be costly and expensive failures, gave up their tanks and made a contract to deliver their sewage upon Heathcote Farm belonging to the Earl of Warwick." The only processes which we have ever heard of as having been used at Leamington were the "lime" and the "A B C." The latter of these was not tried until *after* the contract had been made with Lord Warwick. Consequently it was a mere interim arrangement and not a "costly and expensive" failure which drove the Leamington authorities to irrigation.

It is not too much to say that every part of Dr. Folsom's treatise teems with errors. His notice of sewage irrigation is as one-sidely favourable, as his remarks on precipitation processes are unjustly condemnatory. No mention is made of the important results obtained by Mr. Smee, jun., who showed that milk and butter obtained from cows fed on sewage grass became more rapidly offensive than that of cows fed upon normal herbage. No notice is taken of the important evidence of Mr. Markham that irrigation, even with common river water and applied only when necessitated by dry weather, injures the health of the surrounding districts in India. No less has Dr. Folsom left out of account the valuable report of M. Lefeldt, the Prussian commissioner, who complains of the "mephitic odours" on *the* model sewage farm, and who found the stems of grass from irrigated meadows full of unassimilated sewage matters. Irrigation is doubtless valuable in climates where there is no rain during half the year, but in England where the average supply of moisture is too great for our most valuable crops it is a delusion which it will puzzle posterity to account for.

In short, we must pronounce Dr. Folsom's treatise an utterly untrustworthy compilation, and for the sake of sanitary science in America we regret that it has ever appeared.

The other portions of the volume are of much greater value.

CORRESPONDENCE.

ANALYSES OF MANGANESE OXIDES.

To the Editor of the Chemical News.

Sir,—I notice in the Chemical News (vol. xxxiv., p. 30) that Mr. Alfred Allen has been asking me some more questions with regard to the determination of MnO_2, Mn_2O_3, &c., which he ought to be able to answer himself. I have already given him a capital reference and regret to find that he cannot, or will not, avail himself of it. But perhaps I had better reply to his questions, though I am afraid that will not help him much.

1. How does Dr. Phipson know that the 6·20 per cent of Mn_2O_3 was not made up of 3·41 MnO_2 and 2·79 MnO?

Answer.—Because there is no MnO in the sample.

2. If he does *not* know how, &c.?

Answer.—He *does* know.

3. What process was employed for the determination of the main quantity of MnO_2, and would not that amount include the 3·41 per cent assuming the latter to have any existence?

Answer.—No "main quantity" of MnO_2 was determined.

4. If the result of the determination of MnO_2 72·17 per cent represents the *total* quantity of that oxide present, must not the remainder of the Mn necessarily have existed as MnO and not as Mn_2O_3?

Answer.—Certainly not (*vide* answer to question 1).

5. If the last question is answered in the affirmative has not Dr. Phipson counted his oxygen twice over?

Answer.—It is *not* answered in the affirmative.

I am, &c.,

T. L. Phipson, Ph.D.

London, July 22, 1876.

PS.—In my last letter the word "*discovered*" was erroneously inserted for "*determined*."

PRIZE FOR HARDENING PLASTER CASTS.

To the Editor of the Chemical News.

Sir,—Will you kindly inform me if the German prize for a method of preserving plaster casts has been awarded? The consignments were to have been in by January last, but I have not been able to obtain any information about the matter.—I am, &c.,

D. D. Redmond.

July 24, 1876.

ORGANISATION AMONG CHEMISTS.

To the Editor of the Chemical News.

Sir,—The formation of an Institute of Professional Chemists has undoubtedly been mooted mainly for the purpose of raising the status of the chemists; but some of the proposed regulations in the scheme put forward by Mr. Pettengill's clients in the Chemical News of the 9th ult., do not by any means appear likely to further this end. For instance, a person would be eligible for membership if he had "practised on his own account in the profession of a consulting or analytical chemist."

This would obviously admit all those quacks who have chosen to dub themselves "Analytical and Consulting Chemists" without the faintest qualification for the work, while at the same time many of the so-called "works' chemists" who have had a thoroughly good scientific training with much experience in technological work, would, unless they had *advertised* themselves as "Analytical and Consulting Chemists," be excluded.

For the purpose of guiding in its action towards the proposed Institute, I am instructed by the Council of the Faraday Club (which consists solely of *chemists* of this district) to ask publicly of those engaged in forwarding the new scheme:—

1. How are "high" and "low" analysts and quacks in general *now in practice* to be excluded?

2. How will technology be represented on the Board of the proposed Institute?—I am, &c.,

Pro the Council of the Faraday Club,
George E. Davis (Hon. Sec.).

Runcorn, July 21, 1876.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances, de l'Academie des Sciences. No. 25, June 19, 1876.

Cause of the Movements in the Radiometer of Mr. Crookes.—M. Govi.—Fresnel had found, in 1825, that light bodies freely suspended in an ordinary vacuum might perform under the action of light or heat certain movements, which he referred to the thermic currents of the rarefied gas contained in the receiver. These same movements, obtained in a far more perfect vacuum, have been lately ascribed by Mr. Crookes to the impulsive force of the luminous rays. It is little probable that the displacement of a gas the pressure of which is reduced to a few hundredths of a m.m. can impress an appreciable motion on bodies whose mass is always relatively very large. As for the impulsive force of light, it ought to be *nil* if it be true that light and heat are merely vibratory movements of the ether or of the ultimate particles of bodies. It is no more possible for light to drive a body before it than for the sounds of a musical instrument to sweep along a feather or a particle of dust in the direction in which they are propagated. If the impulsive force of light were proved, it would be necessary to renounce the theory of Huyghens; but before doing that we must at least exhaust all possible means of explaining the movements studied by Fresnel and by Mr. Crookes. If the thermic currents of rarefied gases contained in the receiver where the movement is produced do not suffice for the explanation of the facts observed, there is another cause of displacement much more efficacious, but hitherto not taken into account, which may well give the true explanation of the phenomena. This cause is merely the dilation by heat, or the contraction by cold, of the gaseous layers which all bodies retain on their surface, even when placed in an absolute vacuum. The mass of these gaseous strata is far from being insignificant relatively to that of the bodies which retain them, especially when they are in a very fine state of division, like lamp-black, platinum-black, &c.; or if they are endowed with an especial affinity for certain gases, as palladium for hydrogen. If we admit that this is the true explanation of the facts studied by Mr. Crookes, we may construct insensible radiometers by heating the immovable discs of the apparatus during the action of the mercurial pump. So long as we have not removed from the apparatus the source of movement just pointed out, it is needless to have recourse for the explanation of the phenomena to an impulsive force, which would be at variance with all that we know best concerning the nature of light. M. Fizeau gave an account of an experiment which does not seem favourable to the explanation given by Govi. If a series of equidistant candles are placed around a radiometer, forming a circle of about 50 centimetres in diameter, in the centre of which is the instrument, it is equally and symmetrically illuminated all around its axis of rotation, so that the discs whilst turning receive constantly the same quantity of light as well on their blackened as on their polished surfaces. The rotatory movement being established, under these conditions, with a speed of about ten revolutions in seven seconds, the number of rotations was carefully taken in each successive five minutes. The speed was found constant, and did not slacken during an entire hour. In these conditions would not the speed of the rotation diminish and cease at the expiration of a very short time if it was really produced by the liberation of condensed gases or vapours from the blackened surfaces? We cannot from the uniformity of the illumination admit the supposed alternations of condensation and emissions necessary for the continued maintenance of the movement.

Existence of Mercury in the Cevennes.—M. Leymerie.—The author confirms the existence of mercury in the Department of l'Herault, as pointed out by N. Thomas (*Comptes Rendus*, May 8).

Influence of Temperature upon Magnetisation.—M. J. M. Gaugain.—Not adapted for abstraction.

Extension of the Principle of Carnot to the Theory of Electrical Phenomena: General Differential Equations of Equilibrium and of the Movement of any Reversible Electric System whatsoever.—M. G. Lippmann.—A mathematical paper, incapable of useful abstraction.

Differential Actinometer.—M. N. Egoroff.—The author describes his apparatus, with which he hopes to determine the coefficients of absorption of the ultra-violet rays.

Researches on the Commercial Analysis of Raw Sugars.—A. Riche and Ch. Bardy.—The chief novelty in the authors' method is that they take a sample five times larger than usual, and operate upon one-fifth of the solution, in order thus to obtain a fairly representative sample. They also employ a modification of the ordinary polarimetric tube.

New Class of Colouring Matters.—M. Ch. Lauth.—Reserved for insertion in full.

Certain Derivatives of Isoxylene.—M. Ch. Gundelach.—This paper contains an account of the chloride of isotolyl and of isotoluic aldehyd.

The Nickel Ore of New Caledonia, or Garnierite.—M. J. Garnier.—The nickel ores of New Caledonia are not arsenio-sulphides like those hitherto utilised, but silicates of nickel and magnesia. The ore is found amidst the masses of serpentine very abundant in certain parts of the island, and associated with euphotides, diorites, amphibolites, &c. The nickel is accompanied by iron, chrome, and cobalt; these metals, especially the two former, are of an unexampled abundance. The cobalt is associated with manganese.

On Nitro-Alizarin.—M. A. Rosenstiehl.—The author demanded the opening of a sealed paper deposited by him on March 13, 1876, and containing an account of the new compound. Madder-red exposed to nitrous vapours becomes orange, and the shade thus produced is only rendered more brilliant by washing and by boiling soap-lyes. Turkey-red undergoes the same change, the resulting colour being quite as solid as that from which it is derived, and of a tone and a brightness which could hitherto only be produced on printed goods by means of chromate of lead. The orange obtained by the action of nitrous vapours is so much the brighter, as the madder-red contains less purpurin. The colour can scarcely be withdrawn from the fibre upon which it is deposited without attacking the latter. The small quantity obtained dyed an orange shade with mordants of alumina. Nitrous vapour brought in contact with alizarin in solution, or suspended in water, acetic acid, alcohol, sulphuric acid, &c., produced compounds of a yellow colour, but devoid of tinctorial power. This result agrees with that of Ntenhaus, who found that alizarin was reduced by nitrous acid to anthraquinon under circumstances very analogous. Fuming nitric acid employed alone, or mixed with sulphuric acid, did not give a satisfactory result. The author then prepared the new colour by pouring the commercial alizarin paste into large glass flasks, coating the interior therewith by means of agitation, draining, and drying, thus leaving the flasks lined with a layer of finely divided alizarin. They were then filled with nitrous vapours and stoppered, when in a few minutes the colour of the alizarin was changed, and the gas decolourised. Two colouring matters were formed, one of which, probably unchanged alizarin, gave a red with aluminous mordants, whilst the new substance dyed an orange. The new colour is composed of—

Carbon	58·94
Hydrogen	2·45
Nitrogen	4·91

answering to the formula $C_{14}H_7(NO_2)O_4$. By the reduction of nitralizarin the author has obtained two products, which are formed successively: the one dissolves in alkalies with a blue colour, and dyes a garnet with aluminous mordants; the other dissolves in alkalies with a brown colour, and dyes a catechu colour with alumina.

Bulletin de la Société Chimique de Paris,
No. 1, July 5, 1876.

On Benzylic Naphthalin.—M. Pierre Miguel.—Not suitable for abstraction.

Metallurgy of Silver in the Moist Way.—M. Antony Guyard (Hugo Tamm).—This paper is devoted to the treatment of the sulpho-antimoniuretted ores of Bolivia, known as *Rossicler*,—very rich, but so difficult to treat in the dry way that many smelters refuse to work them. They may, however, be very advantageously treated in the moist way, the sole condition of success being the use of a quantity of acid sufficient to oxidise the sulphur and all the metals. The following analyses show the general composition of these ores:—

	1.	2.	3.
Sulphur	18·35	16·20	17·85
Silver	48·15	46·10	38·10
Antimony	10·85	7·10	28·35
Iron	5·60	7·70	0·93
Zinc	4·50	4·10	5·25
Bismuth	2·20	—	—
Lead	traces	traces	1·50
Arsenic	0·15	0·10	0·85
Copper	—	—	0·25
Chlorine	—	0·15	—
Gangue	10·20	18·55	7·50
	100·00	100·00	100·00

Analysis of the Peroxide of Manganese.—Dr. T. L. Phipson.—Already noticed.

Memoir on the Determination of Nitrates.—M. Ferd. Jean.—For the analysis of commercial samples of nitre the author recommends the following procedure:—Into a small glass flask, holding about 200 c.c., introduce a concentrated and very acid solution of ferrous chloride. The flask is closed with an india-rubber stopper pierced with a hole, through which pass a delivery tube under a leaden shelf in a tank of water lined with lead, and a very short tube, to which is fixed a small funnel by means of a flexible caoutchouc tube, the communication with the flask being intercepted by means of a Mohr's spring-clip or a small glass tap. The trough being filled with water, the ferrous chloride is raised to a boil, and, as soon as the sound made by the condensation of the acid on the water of the trough announces that a vacuum has been made in the flask, a gas-jar filled with water is placed over the opening in the shelf. The jar should be of the capacity of 200 c.c., graduated in tenths. Then we pour into the funnel 5 c.c. of a solution of nitrate of soda, formed by dissolving in a litre of 66 grms. of pure nitrate of soda recently melted at a low temperature. The solution of ferrous chloride being kept at a boil, the solution of nitre is allowed to enter the flask drop by drop, taking care not to empty the funnel completely: 2 to 3 c.c. of distilled water are then placed in the funnel and allowed to enter the funnel, and finally the funnel and the tube are rinsed with 5 to 10 c.c. of fuming hydrochloric acid. The binoxide of nitrogen produced by the decomposition of the nitrate of soda enters the graduated jar, and as soon as the sound announcing the presence of a vacuum in the flask is heard the graduated jar is withdrawn and allowed to stand on a support in the trough. This first operation makes known the volume of gas obtained from a known weight of nitre, without it being needful to take account of the corrections for temperature, pressure, &c. Into the flask are then introduced 5 c.c. of a solution of the nitre in question in 100 c.c. of distilled water, and the salt is decomposed. This solution is made by dissolving 6·6 grms. in the same manner as the foregoing, and the binoxide of nitrogen is collected in a second graduated jar. The two jars are kept till they have acquired the same temperature and the respective volumes of gas produced are read off, care being taken to keep them immersed so that the water may stand at the same level within and without. The volume of gas produced by a given weight being thus known, the proportion of real nitre existing in the sample under examination is readily calculated.

(In a subsequent part of the paper the author speaks of the determination of nitrogen by the "procede Winckling." On careful examination this proves to be a Gallicised version of the name of Mr. Wanklyn.)

On Isobutylenic Chlorhydrine, and on the Law of the Addition of Hypochlorous Acid.—M. L. Henry.—Already noticed.

On the Law of Dulong and Petit.—M. A. Terreil.—Already noticed.

On Erythrophlæum Guineense and couminga.—MM. N. Gallois and E. Hardy.—A chemico-pharmaceutical paper, not adapted for abstraction.

On Certain Derivatives of Isoxylene.—M. Ch. Gundelach.—Already noticed.

Justus Liebig's Annalen der Chemie,
Band 181, Heft 3.

Combination of the Elements of the Nitrogen Group with the Radicals of the Aromatic Series: Section I.; on Aromatic Phosphorus Compounds.—A. Michælis.—A treatise extending to one hundred pages, and utterly incapable of useful abstraction.

On Ammonium Compounds.—W. Lossen.—Likewise not adapted for abstraction.

On Benzhydroxamic-ethylester.—Dr. Martin E. Waldstein.—The author describes the properties of this compound, to which he assigns the formula—

$$N(C_7H_5O)(C_2H_5)HO,$$

and its silver salt, and then discusses its constitution, with those of ethyl-benz-hydroxamic acid, benz-hydroxamic acid, and the benz-hydroxamates; the decomposition of benz-hydroxamic-ethylester by hydrochloric acid, and its methyl compound.

Occurrence of Arsenic in Ancient Bronzes.—H. Spirgatis.—The author has found arsenic in old Prussian bronzes to the extent of 3·52 per cent.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

Improvements in the manufacture of chlorine. H. Deacon, Appleton House, Widnes, Lancaster. March 11, 1875.—No. 906. This invention consists in using a mixture of common salt or other similar chloride with a compound or salt of copper, or with other so-called chemically active salt, such as is now employed in what is known as Deacon's process for making chlorine from hydrochloric acid gas and air, previously mixed and heated in combination with a separate source of hydrochloric acid gas, which may be from the well-known manufacture of sulphate of soda by reacting on common salt with sulphuric acid, or otherwise obtained. The common salt used in carrying out this invention may be in grains, which may either be moistened with a solution of the so-called chemically active salt or salts, which may, for example, be sulphate of copper; or the common salt and sulphate of copper may be in solution, and this solution may be used to impregnate pieces of burnt clay or other porous materials therewith, the mixture or impregnated material being subsequently dried. Or salt mixed with copper ore—such, for example, as the sulphurets or the oxides—or with other natural or artificially produced insoluble compounds of copper, may, in a fine state of division, be employed in lieu thereof, or in conjunction with the soluble salts of copper before referred to. The apparatus, in which the mixtures as described may be used in combination with a separate source of hydrochloric acid, may be a column or tower, or a number of columns or towers connected together, and made of iron or brickwork or both, as more fully described in the Specification of a Patent granted to me on September 13, 1870, No. 2469. During the manufacture of chlorine by this in-

vention, chloride of copper is volatilised; and it is by this invention obtained in a dry state from the gases issuing from the apparatus by passing them through a suitable column or tower made of stone or other suitable material, and partly filled with pieces of burnt clay or other similar material, the whole arrangement acting as a "scrubber" of the gases, and being kept at any temperature between that at which aqueous hydrochloric acid gas condenses, and that at which chloride of copper sublimes, say about between 230° and 600° F. The chloride of copper condenses in this apparatus in a state much like wool, and may be removed from time to time, and utilised; and this method of separating chloride of copper from gases containing it may be employed whenever these gases containing it are obtained in the manufacture of chlorine by any other process than the process described herein.

Improvements in apparatus for ventilating mines. W. Knott, Wigan, and T. Rudd, Blackford, near Wigan, Lancaster. March 12, 1875.—No. 916. Our invention consists in placing the wings of ventilating fans at an angle to the axis instead of parallel thereto as now usual, also in making the casing of sides flared east- or west-right-ten instead of brickwork; also in varying the discharge orifice by means of a pair of plates hanged together, and moved to and fro in the flue; also in the use of one or more stationary plates that are put into the flue at various distances from the sides to reduce the discharge orifice; also in driving the said fans by means of steam-engines set diagonally on the frame supporting the fan-shaft.

Improvements in apparatus for the evaporation or concentration of fluids at high or low temperatures with or without the application of a current of air or gases. W. Morgan-Brown, Southampton Buildings, London. (A communication from O. A. Hagemann, Copenhagen.) March 10, 1875.—No. 969. This invention consists in evaporating fluids by letting them trickle down vertical or conical tubes, the outer part of such tubes being heated by steam or fire, and in some cases currents of air, cold or warm, are passed up the interior of the tubes in the contrary direction to falling fluid to assist the evaporation by removing the vapour or adding to the heat of the liquid being evaporated.

Improvements in the treatment of sugar-cane for the manufacture of sugar and of paper-pulp, and in the machinery or apparatus employed therein. J. H. Johnson, Lincoln's Inn Fields, Middlesex. (A communication from J. B. J. Mignon and S. H. Rouart, both of Paris.) March 16, 1875.—No. 973. This invention has for its object treating sugar-cane in such a manner as to render the subsequent juice more complete, in order to obtain an increased yield of sugar, which result has also the effect of bringing the cane-trash into a better condition for the manufacture of paper, for which purpose it may be utilised. According to this invention it is proposed to split the cane in the direction of its length before it is subjected to the actual or final crushing operation.

Improvements in the manufacture of sulphate of soda or potash and bleaching-powder, and in apparatus employed therein. G. D. Mease, Lake Chemical Works, South Shields. March 16, 1875.—No. 977. This Provisional Specification relates to the manufacture of sulphates by the direct action of sulphurous acid, air, and steam upon chlorides of sodium and potassium. Also the processes for producing chlorine and for preparing lime for the manufacture of bleaching-powder.

Improvements in the manufacture of soap. S. S. Lewis, Southampton Buildings, London, and A. Copie, Bolsover Street, Middlesex. March 17, 1875.—No. 988. The said invention relates to the mode of and means for improving the qualities and decreasing the cost of hard, soft, and toilet soaps. We dissolve ordinary soap, and mix with the solution china clay or other ingredient. We use this compound as a vehicle or body to hold the chemicals: we also add to the compound a portion of *poudre de savon de palm*. We add perfume when the compound is cooling for the toilet soap in the usual manner. The detergent or cleansing property of this soap is the silicate of soda.

Improvements in forming the hearth of puddling-furnaces. W. Inns, Stockton-on-Tees, Durham. March 18, 1875.—No. 1005. According to my invention I take "best tap" in the liquid state direct from the cinder bottom furnace, and before it becomes cool cover with a layer of the same of suitable thickness the cast-iron plates of the hearth of the puddling furnace.

Improvements in the manufacture of colouring-matter suitable for dyeing and printing. T. Holliday, Huddersfield, York. March 20, 1875.—No. 1031. Chlorinated or bromnated anthrachinon, obtained as described in the Specification of Letters Patent granted to Charles Liebermann and Charles Graebe, dated December 18, 1868, No. 3850, or otherwise, is treated with strong sulphuric acid, and compound obtained is soluble in water. The product is then diluted with water, and the excess of acid is contains neutralised with an alkali or an alkaline carbonate. The clear liquid obtained is then concentrated and heated with caustic alkali, as is now well understood, until the colour is developed.

Improvements in the manufacture of colouring matters. F. Versmann, Ph.D., Brocknock Crescent, Camden Town, Middlesex. March 20, 1875.—No. 1038. This Provisional Specification describes the separation of the yellow dye, known as chrysotoluydin or phosphine, from rosanilin, or from any by-product, residue, or refuse resulting from the manufacture of rosanilin, by means of bisulphide of carbon or petroleum.

Improvements in converting glassy slag resulting from metallurgical operations for the utilisation thereof. F. W. Dahne, Swansea, Glamorgan. March 22, 1875.—No. 1052. This invention mainly consists in converting the glassy slag resulting from iron blast-furnaces and other metallurgical operations into a stony or basaltic mass, and also casting said slag into any shape required. The slag is cast into hot moulds, which are heated and kept at a high temperature, and then allowed to cool for about twenty-four hours. Arrangements for carrying out this invention are described in the Specification.

Certain improvements in the construction of filters for the purification of water and other liquids. H. Rawlings, Stamford Street, Lambeth. March 23, 1875.—No. 1063. The nature of this invention is to provide a means of controling the currents of liquids passing through any filtering medium and substance by mechanical arrangements and dispositions in the filtering vessels to attain this result, and to construct portable and table filters on an improved plan, that storage of filtered waters may be unnecessary. Also to provide a ready means of regulating the flow of water through filters in the total quantity of liquid delivered, and for entirely stopping the flow if required.

Improvements in the treatment of slag or scoria, and of iron. J. J. Bodmer, The Grove, Hammersmith, and L. R. Bodmer, Lansdowne Road, Notting Hill, Middlesex. March 23, 1875.—No. 1054. Our invention consists, first, in disintegrating or granulating the scoria or slag from blast-furnaces and other furnaces by means of jets of water directed projected against the flow or a ream of slag on its issuing from the furnace or runner. Secondly: in disintegrating or granulating iron in its liquid condition as its flow from the furnace or runner by jets of water, and also in so disintegrating, granulating, and partly fining the iron by using jets of steam either alone or together with jets of water, the oil integrated iron falling into water.

Improvements in the manufacture of glucose-sugar, and in obtaining infusions and extracts for brewing and other purposes. J. N. Lesseware, Bow, Middlesex. March 24, 1875.—No. 1083. The invention consists, first, in causing the materials to circulate continuously through the converter, whereby the process of converting them into glucose or grape-sugar is accelerated, the same process being also applicable for obtaining infusions and extracts for brewing and other purposes. Secondly; in decolorising the liquor by means of sulphurous acid gas and its passage from the converter to the neutraliser.

An improved method of and apparatus for carbonising coal, slack, peat, wood, bones, and other like materials, subjected to a coking process, or to destructive distillation, whereby commercial products are obtained, and the vapours or gases utilised. J. Nicholas, Hope, near Mold, Flint. March 27, 1875.—No. 1116. The features of novelty which constitute this invention consist in constructing an apparatus, being a chamber, oven, or vessel of fire-brick or iron with a range of fire-bars at the bottom, so arranged that they can be dropped to allow the contents of the chamber to fall out. On the top of the chamber there are apertures, and to one of these there is connected a pipe which leads to a condenser. The condenser is connected to a purifier which is connected to an exhausting force-pump. This pump propels the incondensible gases to where they are to be stored or utilised. Attached to the condenser is a pump to free it from the condensed products.

Improvements in purifying raw or partly refined sugar. R. F. Smith, Greenock, Renfrew, North Britain. March 29, 1875.—No. 1136. The feature of novelty which constitutes this invention is the use of steam, conjoined with a vacuum, for the purification or partial purification of raw or partly refined sugar in the manner described, or any mere modification thereof.

Improvements in machinery or apparatus for the manufacture of pulp for paper. De'Angelis Rocco, Rome, Italy. March 31, 1875.—No. 1155. The wood from which the pulp is to be made is first cut into very small pieces by means of a revolving cylinder provided with a very large number of steel knives, under which is drawn a carriage on which the wood is fixed. The wood thus prepared (straw or rags may be employed) is then placed in a cylindrical wooden vessel containing water, and provided with a mixing wheel. Sulphurous acid gas is introduced into this vessel, and the substances under operation are converted into a colourless pulp, which is then conveyed to a hopper, from which it passes on to an endless cloth, and thence between a revolving granite cylinder and concave granite bed. A tube then conveys it to a drum provided with three receivers, and the pulp which has become reduced to the requisite degree of fineness passes through a metallic wire gauze into a box beneath. The pulp not sufficiently reduced passes out of the drum, and is carried back by a chain-pump to the hopper, to be again passed under the granite cylinder.

NOTES AND QUERIES.

Decomposing Furnace.—In reading over the discussion on Jones and Walsh's decomposing furnace (CHEMICAL NEWS, vol. xxxiv., p. 281) I see the percentage of sulphate put down from a calculation made during the discussion at 114. Should it not from the data given be rather more, viz., 117·85.—A PRIVATE STUDENT.

THE LATE SIR CHARLES WHEATSTONE, F.R.S.

The Physical Society of London, with the concurrence and co-operation of the Representatives of the late Sir Charles Wheatstone, are preparing to issue a collected edition of his published and unpublished scientific papers. Separate copies of several of the former being wanted for the use of the printers, the undersigned will be glad to receive offers of them on loan or for sale.

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THE CHEMICAL NEWS.

VOL. XXXIV. No. 871.

METHODS OF CHEMICAL DECOMPOSITION AS ILLUSTRATED BY WATER.*

By Prof. J. H. GLADSTONE, Ph.D., F.R.S.

AMONG the most venerable of the Chinese classics is the "Shoo King," a collection of ancient historical records; and one of these records, the fourth book of Chow, contains a still more ancient document "The Geat Plan with its Nine Divisions," which purports to date from the early part of the Han dynasty—according to Dr. Legge, about 2000 B.C. This remarkable treatise bears on physical as well as ethical philosophy, and commences with an account of the five elements, viz., water, fire, wood, metal, and earth. The first element, water, is said to "soak and descend," and also to "become salt."

This seems to be the earliest known record of that doctrine of elements which spread widely over the ancient world. In the "Institutes of Manu," we read of the elements also as five, but they are earth, fire, water, air, and ether; and according to the cosmogony of the Hindoo legislator, light or fire produced water, and water produced earth. There was, however, at least as late as two centuries ago, a sect in India who held it as a religious tenet that water was the prime and original element.

Similar opinions found their way to Europe. Thus Thales, of Miletus, who flourished in the sixth century B.C., taught that water was the origin of all things. The Greek philosophers generally adopted the theory of several elements, but reduced the number to four—fire, air, earth, and water.

It is hard to say what was the precise meaning attached by the ancients to the term "element." It no doubt did not always convey the same idea. Water also, at least in the Aristotelian philosophy, was a generic expression for many bodies in a fluid condition, and signified not so much a special material substance as an inherent quality of things. Thus it was said to be cold and moist, and the opposite of fire which was hot and dry. In the philosophy of the middle ages we find the same views prevailing, and the early chemists still looked upon water in the same light. Thus Becker enumerated five elements—air, water, and inflammable, mercurial, and infusible earth; while Stahl adopted four—water, acid, earth, and phlogiston. The ancient theory maintained its hold till the experimental philosophers at the latter part of the eighteenth century gave a definite meaning to the term element, and showed that water, air, and earth are compound bodies. Yet the idea of the elementary character of water was not easily abandoned.

In 1781 Cavendish found that when a mixture of what were then called "inflammable air" and "dephlogisticated air" is exploded by a spark in such proportions that the burnt air is almost entirely phlogisticated, pure water condenses on the sides of the vessel, and is equal in weight to the weight of the two airs. His theory was that water consists of "dephlogisticated air united to phlogiston," and that "inflammable air is water united to phlogiston." At the time of explosion, according to him, the excess of phlogiston was transferred from the inflammable to the phlogisticated air, and thus both airs "turned into water." Cavendish also explained Priestley's production of inflammable air on heating iron filings strongly, by contending that the phlogiston of iron united with the moisture from which they had not been freed. Lavoisier gave a different explanation of these phenomena. He held that "dephlogisticated air" is an elementary substance—oxygen—united with imponderable caloric, and that "inflammable" air, or hydrogen, is capable of taking the oxygen from the caloric, thus producing water and heat. "Water is not a simple substance, but is composed, weight for weight, of inflammable and vital air." Thus water was at length deposed from its rank as an element.

In the first year of this century, when the news of Volta's great discovery of the pile was made known in England, Messrs. Nicholson and Carlisle made various experiments with a series of halfcrowns, zinc plates, and pasteboard soaked in salt. Knowing that water conducted electricity, they inserted brass wires through corks at the two ends of a tube filled with water, which they are careful to tell us came from the New River. They were surprised to see a stream of minute bubbles rising from one pole while the other was corroded, and that this decomposition took place at each pole, though they were nearly 2 inches apart. They enlarged the distance, and found that 36 inches of water was too much for their force to traverse. Substituting flattened platinum for their brass wires, they found that the water was decomposed with the production of hydrogen at one end and oxygen at the other.

The old notion that water, by continuous boiling, was turned into stone had been previously dispelled by Lavoisier, but Davy found that some salts and earths remained behind when water was electrolysed, and that when the experiment was conducted in two cells communicating with one another, the liquid in the one cell became acid and the other alkaline. He traced the origin of this in a masterly research, which formed the Bakerian lecture for 1806.* He found that the earthly substances were original impurities in the water, or came from the vessels employed; and using gold cones filled with distilled water and united together by asbestos, he convinced himself that nitric acid was produced at the positive pole and ammonia at the negative. Suspecting that these were produced from the small quantities of nitrogen dissolved in the water combining with the liberated oxygen and hydrogen respectively, he took extraordinary precautions. Making use of water which he had carefully distilled in a silver still at 140° F., and performing the experiment *in vacuo*, or rather in a space which he had twice filled with hydrogen and exhausted as thoroughly as the means at his disposal would permit, he then found that the water was decomposed without the least production of either acid or alkali. "It seems evident then," wrote Davy, "that water, chemically pure, is decomposed by electricity into gaseous matter alone, into oxygene and hydrogene."

In the following year Davy discovered the metals of the alkaline earths, potassium and sodium, and found that when these bodies are thrown upon water they decompose it, appropriating its oxygen and setting free its hydrogen. This is due to the superior chemical power or "affinity" of the alkaline metals.

In 1846 Mr., now Sir William, Grove observed that when steam was subjected to something like a white heat, small quantities of mixed oxygen and hydrogen gas were always produced.† It has since been shown that the gases are actually dissociated in one part of the flame of the oxy-hydrogen blowpipe, after their first combination.

It thus appears that there are three distinct ways in which water may be decomposed:—By an electric current;‡ by some substance which has a superior attraction for one of its elements; or by heat alone.

It will readily be understood that the power of any one of these agents will be augmented by the co-operation of

* A lecture delivered at the Royal Institution of Great Britain, Friday, May 5, 1876.

* *Phil. Trans.*, 1807, p. 1.

† *Ibid.*, 1847, p. 1.

‡ Though voltaic electricity alone is referred to in this discourse, it is well known that other forms of the same agent will effect chemical decompositions. Thus Prof. Andrews has resolved pure water into its constituent gases by frictional electricity, and by that derived from the atmosphere.

either of the others. Thus, the action of chemical affinity is usually augmented by heat; for instance, if a pellet of sodium be thrown upon cold water it melts, on account of the chemical action at once set up, but if upon boiling water it not only melts but bursts into flame through the greater violence of the action. This is the reason why, in Priestley's experiment, iron at a red heat decomposed team, though it will not do so at ordinary temperatures.

Similarly the electrolysis of water is much facilitated if there is some chemical affinity between the oxygen and the metallic conductors. It is generally said that it requires two cells to decompose water electrolytically. Now, it is true that if platinum poles are employed there is no visible disengagement of gas when one cell only is used; but with zinc poles a single cell of Bunsen or Grove is amply sufficient. Zinc alone without the voltaic current is incapable of displacing the hydrogen in water; but it must be borne in mind that the tendency to combine with oxygen is a constant property of this metal, and is easily brought into activity by the co-operation of the feeble voltaic current. The increased effect upon electrolysis which is due to the nature of the poles is in proportion to the electromotive force of the different metals. For pure water the order is—zinc, lead, iron, copper, silver, platinum, as tested by a galvanometer. This difference of result according to the nature of the metals employed in the electrolytic cell appears generally to have been overlooked, and it is the feeblest metal—platinum—which is usually employed for experimental purposes, doubtless because it is incapable of oxidation—the very reason of its feebleness.

When the other metals of the above list are used, not only does the positive pole oxidise, but the oxide, or rather hydrate, dissolves more or less in the pure water, and becomes itself an electrolyte. The consequence of this is that the positive electrode gradually wears away, while the metal is transferred to the negative electrode, and is deposited upon it in crystalline fringes or filaments. With silver these are particularly beautiful, as they assume arborescent forms, especially when able to spread over the surface of the containing vessel.

The temperature also of the liquid subjected to electrolysis has a great influence upon the result. Thus in an experiment where zinc poles and pure water were employed, the deflection of a galvanometer was found to increase about fourfold between 5° C. and 80° C., and the action augmented nearly *pari passu* with the temperature.

A similar result occurs, as might be expected, when two dissimilar metals, such as zinc and copper, are placed in cold water in connection with one another, and the water is heated. The deflection was found to double between about 30° and 80° C., but the difference for every 5° at the higher temperatures was several times greater than at the lower ones.

Another very important point in the electrolysis of water is to reduce to a minimum the very great resistance offered by the water itself. This is effected by bringing the electrodes as near to one another as possible; and for the same reason, if the force be generated by the action of two dissimilar metals upon water, they should be brought into the closest proximity.

A still more powerful means of decomposing water would evidently be a combination, not of two, but of all three agents, chemical affinity, heat, and voltaic force acting at an insensible distance. Thus zinc has a strong affinity for oxygen, but is unable of itself to displace the hydrogen of water; when united, however, with a more negative metal, such as copper, its power is enhanced to such a degree that a separation of the constituents does take place; but in the ordinary arrangement of a voltaic cell the action is so slight that no evolution of gas is perceptible. To produce a visible effect, the metals must not only be close together, but ought to touch one another at a myriad of points. This may be brought about by depositing the copper upon the zinc in a spongy condition; then the zinc will be oxidised, and bubbles of hydrogen will appear among the branches of the copper, even at the ordinary temperature, but the effect is greatly increased by the application of heat.

The arrangement just described is the "copper zinc couple," which has been employed by Mr. Tribe and the speaker, and more recently by others, to effect a variety of chemical decompositions. Zinc foil is immersed in a solution of sulphate of copper until a black velvety deposit of the metal is produced: the soluble salts are then washed away, and the couple after being dried is ready to be placed in any liquid it is desired to decompose. Water was the first body experimented upon, and it was found that the action would go on as long as there was any metallic zinc left in union with the copper, the amount of hydrogen evolved gradually diminishing, though varying somewhat with the temperature of the day. The great influence exerted by heat is, however, better shown in the subjoined table, which gives the results of an experiment reduced to the unit of an hour's work.

At 2·2° C.	.. ..	1·1 c.c. of hydrogen produced.
22·2	.. ..	5·5 ,,
34·4	.. ..	13·9 ,,
55·0	.. ..	62·0 ,,
74·4	.. ..	174·6 ,,
93·0	.. ..	528·0 ,,

These figures strikingly exhibit the rapid acceleration of the action at the higher temperatures.

A greater effect may be produced by substituting for the copper a still more negative metal. Thus a zinc platinum couple acts with much greater energy upon water. Gold zinc couples, and many others also, have been tried, but gold has the practical disadvantage that the precipitated metal does not adhere well to the zinc. Aluminium alone does not decompose water, not even, according to Deville, at a red heat; but an aluminium copper couple decomposes it slowly, and an aluminium platinum couple more rapidly, even in the cold. One of the most recent discoveries is that aluminium when amalgamated with mercury is converted into hydrate, even by the moisture of the air. The most powerful combination, however, might be expected to be that of the most positive and the most negative metal which can be conveniently brought together. These are magnesium and platinum; and in fact, if strips of magnesium foil be coated with finely-divided platinum by immersing them in platinic chloride, and the resulting salts be washed away, a couple may be obtained which produces a most vigorous evolution of hydrogen when it is placed even in cold water.*

The decomposition of water by the copper zinc couple was of course a matter of little practical importance; it does, however, yield hydrogen in a state of purity, even though the zinc be largely contaminated with such a substance as arsenic—a fact which may prove of great consequence in medico-legal inquires. These observations on water led to a long series of experiments on other bodies, especially organic compounds. The action of the two metals in conjunction frequently effects not only the splitting up of a compound, but a re-distribution of its elements; and this has resulted not only in the discovery of a simple means of producing various substances previously known, but the formation of several others hitherto unknown. Thus the first trials were made on iodide of ethyl in the hope that Prof. Frankland's beautiful process for making zinc ethyl might be simplified; and not only was a better result obtained in a shorter time, but when the experiment was performed in the presence of alcohol it was found that pure hydride of ethyl was given off, and

* Phenomena resulting from different metals in combination have frequently been observed by several experimenters, and some of them are described by Mr. W. N. Hartley in the Chemical News (vol. xiv., p. 73); but it does not appear that the metals have ever been freed from concomitant salts, or their action understood or appreciated.

a new substance, the iodoethylate of zinc, remained in the flask.

Among the bodies which may be prepared more easily or in greater purity by the copper zinc couple are the following:—

Hydrogen.	Olefiant gas.	Diallyl.
Methyl hydride.	Acetylen.	Zinc ethiodide.
Ethyl hydride.	Propylen.	Zinc ethyl.
Propyl hydride.	Diamyl.	Zinc amyl.
Amyl hydride.		

The substances that have been discovered by this agency are the following:—

Zinc propiodide	$Zn(C_3H_7)I$.
,, propyl	$Zn(C_3H_7)_2$.
,, isopropyl	$Zn(C_3H_7)_2$.
,, ethylobromide	$Zn(C_2H_5)Br$.
,, iodoethylate	$Zn(C_2H_5O)I$.
,, bromethylate	$Zn(C_2H_5O)Br$.
,, chlorethylate	$Zn(C_2H_5O)Cl$.

Zinc propyl is a volatile liquid body, of sp. gr. 1·098, which takes fire spontaneously in the air, burning with a bluish white flame. The haloid ethylates are a new class of bodies which have been prepared from both ethyl iodide and iodoform, and their corresponding bromine and chlorine compounds.

The couple has also thrown some light upon the chemical structure of some of these organic bodies, as, for instance, by its different behaviour with the two isomeric bodies, chloride of ethylen and chloride of ethylidin. This is a direction in which future investigation is likely to be rewarded.*

This method of quietly bringing about a chemical change has found a practical application in the hands of Prof. Thorpe for determining the amount of nitrates in samples of water—a question of great importance, which has hitherto been also one of great difficulty. The nitric acid is reduced by the couple to the condition of ammonia. In a similar way chlorates are reduced to chlorides.†

The progress of research by means of the copper zinc couple was interrupted by the discovery of a curious reaction, by which also water and other substances may be decomposed. Metallic aluminium does not attack water by itself, neither does iodine; but if the three are brought into contact, oxide of aluminium is formed and hydrogen gas is evolved; and not only this, but the solution so produced will cause the oxidation of any excess of aluminium with the formation of an equivalent amount of hydrogen. It is not even necessery that free iodine should be employed, for iodide of aluminium itself will determine the oxidation of any amount of metal. This action is greatly quickened by coupling platinum with the aluminium. By employing alcohol instead of water a similar action is set up, and this has led to the discovery of aluminium ethylate, $Al_2(C_2H_5O)_6$, alcohol in which the replaceable hydrogen is substituted by aluminium. It is a solid body at the ordinary temperature, but easily melts, and is capable of being sublimed unchanged, its vapour burning with a luminous flame and white smoke of the oxide of metal. Other compounds prepared by this singular reaction, and the nature of the chemical changes which occur, are at present the subject of study.‡

* Further particulars respecting the decomposition of water by this special kind of electrolysis may be found in *Proc. Royal Soc.*, 1872, p. 218; *Report Brit. Assoc.* 1872, Abstracts, p. 75; *Journal Chem. Soc.*, 1873, p. 452; *Phil. Mag.*, 1875, pp. 284, 285. The account of "Researches on the Action of the Copper Zinc Couple on Organic Bodies" is given in the *Journ. Chem. Soc.*, 1873, pp. 415, 678, 961; 1874, pp. 208, 406, 410, 615; 1875, p. 508. See also vol. vii. of *Proc. Roy. Inst. of Great Britain*, p. 521.

† *Journ. Chem. Soc.*, 1873, p. 541.

‡ Since this discourse was delivered, this peculiar reaction has been elucidated in a paper read before the Chemical Society, on "The Simultaneous Action of Iodine and Aluminium on Ether and Compound Ethers." An intermediate body, the aluminium iodoethylate, $Al_2(C_2H_5O)_3I_3$, is there described.

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 34.)

Chlorine, Bromine, Iodine, and Fluorine.

By Dr. E. MYLIUS, of Ludwigshafen.

WHILST air is continually introduced so much lime is added that altogether 1·5 to 1·6 equiv. of lime may be present per 1 equiv. manganese, so that, deducting the lime necessary to form chloride of calcium, only about ½ equiv. of lime may be present to 1 equiv. of manganese in the mud produced. This is at first white, but becomes gradually black as air is constantly introduced. For the charge of a cylinder to yield 2500 lbs. manganese there are required, for perfect oxidation, about 4956 cubic metres of air and five hours time; per lb. MnO_2 1·982 cubic metre of air is therefore requisite, of whose oxygen 14·8 per cent is actually utilised.

After completed oxidation the black manganese mud is passed into settling vats, in which it is allowed to deposit until its volume can be reduced one-half by syphoning off the supernatant solution of chloride of calcium. The mud thus concentrated contains about 141 lbs. peroxide of manganese per cubic metre, and is let off into suitable vessels for the production of chlorine.

The advantages of Weldon's process, according to the inventor, are:—The consumption of muriatic acid is smaller than when native manganese is employed, so that, at least in England, 4 tons chloride of lime can be produced, on Weldon's process, with the same quantity of acid which is required for 3 tons on the old process. In Germany and the Continent altogether the proportion may be less favourable, since the English method of developing chlorine in large stills by the introduction of steam is less economical than the Continental procedure in which small chlorine stills are heated externally. But even on the Continent the balance of the consumption of acid is in favour of Weldon's process. The consumption of muriatic acid per ton of chloride of lime is 3301 kilos. at 21° B.

A second advantage of the process is that the residues consist of a perfectly neutral solution of chloride of calcium, whilst on the old process they consist of the more dangerous acid manganese solution and of solid residues not easy to remove from the stills.

The labour required in Weldon's process is less than the old procedure, and the men are less injured by chlorine. For, since the agents, manganese mud, milk of lime, and muriatic acid, and also the residues are all liquids, it is no longer necessary to open the stills and remove the solid residues. Hence every occasion for polluting the air of the still-house by the introduction of chlorine is obviated. The stills are charged and emptied by simply opening cocks.

Weldon's process, lastly, is worked more rapidly than the old method, and requires a smaller number of sandstone troughs, though the latter advantage is out-balanced by the cost of the oxidation apparatus. The productive power of a sand-stone apparatus was, on the old process, 1270 kilos. of chloride of lime weekly; whilst on Weldon's method in Allhusen's works, at Newcastle, the weekly production is 4572 kilos. In the same establishment four hours are required for the oxidation of 2500 kilos. of peroxide of manganese, being at the rate of 115 kilos. oxygen per hour.

The cost of the process in England as compared with the old method may be seen from the following statements of Weldon's:—

* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzenends."

Per 1000 kilos. chloride of lime—

Weldon's Process. Labour, 10s. to 17s.; coal, 750 kilos.; lime, 1400 kilos.; lime-stone for saturating the excess of acid, 250 kilos.

Old Process.—Labour, £2; manganese, £6; lime, 700 kilos.

(To be continued)

ON THE REQUISITE AMOUNT OF SIMPLE FRICTION OF SOFT IRON AGAINST COLD STEEL TO MELT IT.

By B. S. HEDRICK, of Washington, D.C.

The development of heat by friction has been long known. For some time it has also been known that the operations of rolling and rubbing had the effect of changing the molecular structure of iron and steel. These operations will toughen and compact cold iron, and will harden and condense steel. Some time since Mr. Jacob Reese, of Pittsburg, Penn., had occasion to construct a machine for cutting bars of cold hardened steel. For this purpose he mounted a disc made of soft wrought-iron upon a horizontal axis, so as to be rotated with great velocity. With any moderate speed no cutting was produced; but, on giving the disc such a speed of rotation as to cause the periphery of the disc to move with a velocity of about 25,000 feet per minute (nearly 5 miles), the steel was rapidly cut, especially when the bar to be cut was slowly rotated against the disc. Sparks in a steady stream were thrown off. At first it was supposed that the steel was simply rubbed or ground off; but on examining the pile of accumulated particles beneath the machine, they were found to be welded together in the shape of a long cone, similar to the stalagmites in the limestone caves: they were nearly like the spikes of frost as formed in winter on Mount Washington, and illustrated at the Troy Meeting. Real fusion takes place. The steel is melted by the swiftly-moving smooth edge of the soft iron disc, but the disc itself is but little heated. The bar of steel on each side of the cut receives but a slight heat, and the ends are left with a fine smooth blue finish. By this process a rolled, polished, and hardened steel bar, of 2 or 3 inches diameter, may be cut in two in a few minutes. The soft metal disc of iron used was about 42 inches in diameter, and $\frac{3}{16}$ths of an inch thick. The particles fly off in a thick jet or stream apparently white-hot, through which the naked hand may be passed without injury, and a sheet of white writing-paper held in the stream for a minute is not burned nor coloured in the least. They glance off without burning the hand, having assumed the condition which causes the spheroidal state of liquids.—*Proceedings of the American Association for the Advancement of Science, Detroit Meeting, August*, 1875.

ON ROSCOELITE: A VANADIUM MICA.

By JAMES BLAKE, M.D., San Francisco, California.

The mineral to which I have given the name of Roscoelite—in honour of Prof. Roscoe, of Manchester, who has done so much for the chemical history of vanadium—is a well-marked species of mica, containing quite a large percentage of vanadium. It was found in a gold-mine at Granite Creek, El Dorado County, in the lower hills on the western slope of the Sierra Nevada. It occurs in the hanging wall of a small quartz vein, the country rock being porphyry. The mica appears to have been principally deposited in fissures in the porphyry, and is usually found in layers from $\frac{1}{10}$th to $\frac{1}{4}$ an inch thick, and seldom extending continuously for more than 2 or 3 inches. It is also found filling cavities in the quartz. The crystal are quite brilliant, of a dark green colour, seldom more than 0·1 inch long, and, when occurring in fissures, form two series starting from each side of the fissure and meeting in the centre. They are also found in nodules with a stellar arrangement, more particularly in the cavities of the quartz. They are strongly double refracting. Sp. gr. 2·33. They weather into a light yellow wacke. The whole thickness of the vein-matter in which the mica is found is not more than a few inches. The mine in which it occurs has been worked for gold, and it is in these micaceous deposits that the greater part of the gold is found. Some portions are extremely rich, as much as 240 dollars having been washed out from a single panful; and while at the mine I saw 40 dollars taken from a few handsful. The gold is commonly found in the form of fine scales which have been deposited between the crystals of the mica. So generally is it diffused that it is impossible to find a piece of the mica as large as a bean that does not contain gold. The mine is worked by means of an open cut, now about 30 feet deep and 150 feet long.

The most interesting fact connected with this mineral is the large proportion of vanadium it contains, and that, too, in a form in which it has not before been found, unless the small traces of it detected in some basalts should be part of an analogous compound. When I first discovered the mineral I expected to find a mica rich in chromium, and, on heating some of it in a test-tube with HCl, I obtained a green solution. Finding that by continued boiling with acid the whole of the colour was entirely removed from the mica, I availed myself of this method to determine the quantity of what I considered to be chromium; fusing the residue from the acid solution with carbonate of soda and nitre, and precipitating with lead, I also ascertained the amount of the alkalies; and, in presenting some specimens of the substance to the Microscopical Society, and at the Academy of Sciences of California, in September, I made the general statement that it was a potash-mica, containing 23 per cent chromic oxide and traces of lithia. It was not until I had sent a specimen of the mineral to Dr. Genth to analyse that the presence in it of vanadium was discovered, and to him is due the entire credit of having first detected the true character of this interesting mineral. I have availed myself of the action of nitro-hydrochloric acid on the mineral to prepare a considerable quantity of vanadic compounds for physiological experiment, as this affords about the easiest method of obtaining vanadic acid, although it is impossible thus to extract all the vanadium from the mica.—*American Journal of Science and Arts.*

ON ATOMICITY AS A PRINCIPLE OF CLASSIFICATION.

By M. BOURGOIN.

Atomists have taken possession of Gerhardt's theory of types and have subordinated it to a more general principle, that of atomicity. They have said: there is a type *water*, because there exists a diatomic element, *oxygen*; a type ammonia, because there exists a triatomic element, nitrogen. Thus, in this way of looking at things, water would appear as hydrogen twice condensed, in which half the hydrogen is replaced by an atom of oxygen,—

$$H_2H_2\ H_2O.$$

Ammonia is hydrogen three times condensed, in which three atoms of hydrogen are replaced by an atom of nitrogen,—

$$H_3H_3\ NH_3,\ \&c.$$

In this system they replace the simple notion of combination by that of substitution. On the other side, the symbolic radicals of Gerhardt have been analysed, dissected in a

certain manner; they have sought to establish between the atoms that compose them precise ties, admitting especially that, not only heterogeneous atoms exhaust among themselves their disposable atomicities, but that these latter may be interchanged between atoms of the same nature. These hypotheses, which are satisfactory enough when we are treating of saturated bodies, become insufficient when we seek to apply them to incomplete bodies. To remove these difficulties it has been proposed to substitute, for absolute atomicity of the elements, admitted in the outset by M. Kekulé, first, the principle of successive saturation of the atomicities of one and the same atom, the free atomicities of a polyatomic element being necessarily either even or odd; then the principle of relative atomicities, the atomicity of an element depending on the nature of the body with which it is combined. But these new hypotheses, as M. Berthelot judiciously remarks, render the whole atomic theory illusory and bring it back at last to the law of multiple proportions. However this may be, the atomicity of elements is become in the hands of atomists a fundamental principle of classification, not only for grouping simple bodies in natural families, but even for differentiating mineral and organic bodies. Let us take an example: hydrazobenzol and diphenylen-diamin are isomeric. We admit that in the former of these compounds the two atoms of nitrogen, which are not saturated, exchange between themselves their disposable atomicities:—

$$\begin{matrix} C_6H_5-N-H \\ | \\ C_6H_5-N-H. \end{matrix}$$

In diphenylen-diamin the nitrogen is saturated and the two phenylen groups exchange between themselves their two free atomicities:—

$$\begin{matrix} C_6H_4-N_2H_2 \\ | \\ C_6H_4-N_2H_2. \end{matrix}$$

In my opinion the atomicity of the elements can only be admitted without question when treating of a definite specific property, as it belongs to atoms, but it is easy to demonstrate that there is nothing of the sort. Phosphorus combines at most with three atoms of hydrogen; it is then here triatomic, but it is pentatomic in contact with chlorine, because there exists a perchloride, PCl_5; with iodine it forms an iodide, PI_2, which corresponds to no known chloride, &c.

Nitrogen is monatomic in the protoxide of nitrogen, N_2O, as in the hyponitrite of silver of Mr. Divers:—

$$\left.\begin{matrix} N \\ Ag \end{matrix}\right\} O$$

It is triatomic in ammonia, pentatomic in chlorhydrate of ammonia, in cyanuric acid, &c. Nitrobenzine gives successively by reduction, before yielding aniline, azoxybenzol, and hydrazobenzol:—

$$\begin{matrix} \text{Nitrobenzin,} & C_6H_5\ (NO_2) \\ & C_6H_5-N \\ & \quad\quad | \\ & \quad\quad >O \\ \text{Azoxybenzol} & C_6H_5-N \\ \text{Hydrazobenzol,} & NH-NH \\ & \quad\quad | \\ & C_6H_5-NH. \end{matrix}$$

We admit that in the first of these compounds nitrogen is pentatomic, whilst it is only triatomic in two others; but, what shows, as we may say in passing, how subtle and arbitrary are these distinctions is that we may, with quite as much probability, maintain that nitrogen is only diatomic in azoxybenzol, in accordance with the following formula:—

$$\begin{matrix} C_6H_5-N \\ C_6H_5-N \\ N-C_6H_5 \end{matrix} >O = C_6H_5-N-O-N-C_6H_5.$$

Here are then three bodies which are derived regularly the one from the other and in which nitrogen plays a different part. It is pentatomic in nitrobenzin; triatomic or diatomic, at pleasure, in azoxybenzol; triatomic in hydrazobenzol. It is impossible in any natural classification to separate chlorine, bromine, and iodine; but whilst the two first are monatomic, iodine is decidedly triatomic in the compound, ICl_3; and it is the same in the triacetate of iodine of M. Schützenberger:—

$$\left.\begin{matrix} (C_2H_5O)_3 \\ I \end{matrix}\right\} O_3$$

The same difficulties exist with metals. Let us consider at first the metals reputed as diatomic—mercury, for example.

It may be asked, first, What is its atomic weight; second, What is its atomicity? To determine its atomic weights we found upon its vapour-density and on the law of Dulong and Petit. Experiment shows that the density of mercury is equal to 6·97, whence we deduce for its atomic weight with reference to hydrogen:—

$$\frac{6\cdot97}{0\cdot0693} = 100$$

On the other hand, according to the consideration of specific heats, its atomic weight is equal to 200—

$$\frac{6\cdot4}{0\cdot0324} = 200$$

It has been sought to explain this anomaly by saying that the atom of mercury occupies two volumes, a supposition inadmissible, for it constitutes a true begging the question. To remove this difficulty there is only, as it seems to me in the present state of science, one plausible explanation, that is, to admit that atomic weight may vary according to the physical state of the bodies; for mercury in the solid as in the liquid state the vibrating mass is equal to 200; in the gaseous state it is equal to 100. But what becomes then of the invariability of the atomic weights?

Second, mercury forms with chlorine two compounds. We admit that it is diatomic in sublimate.

$$HgCl_2 = Hg'' \left\{\begin{matrix} Cl' \\ Cl' \end{matrix}\right.$$

To preserve for it the same atomicity in calomel it ha been assumed that this latter compound has for its formula:—

$$Hg_2Cl_2 = (Hg-Hg)'' \left\{\begin{matrix} Cl' \\ Cl' \end{matrix}\right.$$

Messrs. Deville and Troost have found that the density of calomel is 8·2 and as there is no dissociation, according to M. Debray, we have for its molecular weight referre to two volumes, hydrogen being taken as unity—

$$\frac{8\cdot2\times2}{0\cdot0692} = 236$$

On the other hand,—

$$\left.\begin{matrix} Hg = 200 \\ Cl = 35\cdot5 \end{matrix}\right\} = 235\cdot5$$

The formula of calomel is then HgCl, a compound in whic mercury is monoatomic. Mercury is therefore sometimes monoatomic, sometimes diatomic in contact with chlorine, which amounts to saying purely and simply that it obeys the law of multiple proportion when it forms several compounds with the same element. The difficulties are still greater when we consider the polyatomic metals, such as iron and manganese. Manganese is monoatomic in permanganic acid; diatomic in protoxide of manganese; diatomic or tetratomic in pyrolusite; tetratomic in fluomanganic acid; hexatomic in the manner of ferricum in braunite; probably heptatomic in the perchloride of M. Dumas, &c. According to the preceding considerations it appears to me doubtful whether the atomicity of

elements can serve for a principle of classification, whether for simple bodies or for compounds.

But the word *atomicity* has been employed in another and perfectly legitimate sense as representing the relative value of molecules among themselves. Thus understood, this notion becomes an important principle of classification, on which it is proper to insist. In 1838, Graham showed that in neutral phosphate of potassium there are three atoms of potassium, and that the acid phosphates differ from this salt only because they contain atoms of hydrogen instead of atoms of potassium. We may remark that it is impossible to divide by 3 the atoms of oxygen in neutral salts, and that, accordingly, these latter contain probably in their molecules three times more potassium than, *e.g.*, nitrate of potassium. We may make an analogous remark concerning the citrates, which are tribasic; for if the atoms of carbon are divisible by 3, it is not the same with the atoms of oxygen and of hydrogen. In the year 1838, Liebig insisted on the necessity of regarding as polybasic the cyanuric, melonic, comenic, citric, aconitic and aconic, tartaric, malic, and fumaric acids. Other proofs came to the support of this view, which is now adopted by all chemists. It is thus that phosphoric ether contains in the same volume three times as much carbon as nitric ether; and this circumstance is decisive, for it shows that the existence of polybasic molecules is in perfect agreement with the gaseous densities of the ethers. We are thus led with M. Berthelot to consider the molecule of a bibasic acid as resulting from the fusion of two monobasic intimately united. These notions on the acids at first defined in mineral chemistry find their application in organic chemistry, which permits us to deduce from them important rules of classification. Let us cite an example. Formerly we expressed formic acid and oxalic acid by formulæ containing the same quantity of carbon; but whilst the former only gives with bases a single series of neutral salts, the second furnishes likewise acid salts and double salts, which is explained in a most natural manner by admitting that the oxalic molecule contains twice as much of carbon as the formic molecule. On the other hand, experience shows that whilst a litre of formic ether contains the carbon of a litre of alcoholic vapour, oxalic ether contains in the same volume the carbon of two litres of vapour of alcohol; it is thus proved that in this latter case the carbon has a condensation double of that which it possesses in formic ether; and thus the molecule of oxalic acid possesses a double capacity of saturation. Analogous considerations are applied to alcohol. They were introduced into science for the first time by M. Berthelot, in consequence of his fundamental researches on glycerin. In fact, there where ordinary alcohol produces only a single compound, with acids glycerin produces three. Or in general terms a single molecule of glycerin may experience three times any one whatsoever of the reactions which are applicable to ethylic alcohol, either separately or simultaneously. Here is, then, a structure which is equivalent to three molecules of ordinary alcohol, a fact which is expressed in a single word by saying that glycerin is triatomic. These considerations naturally lead us to the conception of mixed functions so diffused amongst organic compounds. It is thus that glycol, which is a diatomic alcohol, gives on oxidation two acids: first, glycolic acid, which is at once a monoatomic alcohol and a monobasic acid; secondly, oxalic acid, in the molecule of which the acid function is repeated twice. Let us remark, finally, with M. Berthelot, that the atomicity of alcohols may be defined in the following manner:—An alcohol is *monatomic* when it contains the elements of a single molecule of water replaceable by an equivalent quantity of any acid whatever; it is *diatomic* when the elements of two molecules of water may be replaced separately or simultaneously by two molecules either of one and the same acid or of two other different acids, &c. This atomicity by substitution, thus defined, is secure from all objection, and it ought to be carefully distinguished from the atomicity of elements or the atomicity of addition which is contestable. Finally, it becomes in the hands of chemists a powerful means of classification, since it allows us to distinguish simple functions: first, repeated functions; second, mixed functions. But the notion of function ought, in the present state of science, to be regarded as the basis of every system of chemical classification.

MINERAL PHOSPHATES AND SUPERPHOSPHATE OF LIME.*

By WALTER C. REID.

THE rapid development of the manufacture of artificial manures, and the total inadequacy of bones and bone-ashes to meet alone the requirements of this trade, have caused the consumption of mineral phosphates to increase of late years to an enormous extent; and it is of importance for manufacturers, and others who buy and sell, to know the composition of the raw and manufactured materials, and the influence of the several constituents of the former upon the production of the latter.

The basis of nearly all fertilisers and the staple product of all manure works is superphosphate of lime, and in producing it much depends upon the care and attention given to the selecting of the raw materials, as well as to preparing and dissolving them, for, simple as the process appears, if these are neglected an article quite unfit for use is almost certain to be the result.

Deposits of raw phosphatic materials having different characteristics, in physical appearance and in chemical composition, as well as in the results obtained from them, have been found in nearly every part of the globe. The commercial value of these is chiefly regulated by the percentage of tribasic phosphate of lime they contain. The richer they are in this element the more valuable they are (*cæteris paribus*) for the manufacture of superphosphates. But the amount of phosphate of lime in a mineral cannot be taken as the only criterion of its value, for it sometimes happens that a phosphate containing a lower percentage of this ingredient will make a stronger and better superphosphate than a richer one containing more *delcterious* impurities. The value is very much affected by the amount of carbonate of lime, iron, alumina, and fluoride of calcium present; also by its porosity or density, and facility with which it can be reduced to a fine powder. If not in an excessive quantity, carbonate of lime is rather an advantage than otherwise in the manufacture of a good-conditioned superphosphate, inasmuch as the carbonic acid disengaged from it when acid is applied makes a mass more bulky and open, and causes it to appear porous or honeycombed when finished.

The presence of a large quantity of iron and alumina in mineral phosphates is objectionable, for they not only absorb acid, but superphosphates made from them have a tendency to "go back," or become insoluble again; therefore the unit percentage of phosphate of lime is worth less in minerals containing a good deal of these than in others containing only a little. Fluoride of calcium, which generally accompanies phosphatic minerals, also reduces their value. It wastes acid, and in becoming a sulphate of lime its weight is increased to the detriment of the superphosphate. Silicious matter is a useless ingredient, but a harmless one, except in so far as it causes an unnecessary weight to be moved about, and when in excessive quantity reduces the proportion of soluble phosphate in the superphosphate to such an extent as to make it unmarketable. Ordinary mineral superphosphate contains biphosphate of lime equal to 25 to 28 per cent of tribasic phosphate of lime rendered soluble; and, as it is well known that good Cambridge coprolites are capable

* A Paper read before the Newcastle-upon-Tyne Chemical Society.

of yielding this of a good chemical composition, and in a dry powdery condition, the analysis of this mineral may be taken as a fair standard upon which to assess the value of others.

Cambridge Coprolites come from the Upper Greensand in Cambridgeshire, and occur as small nodular hard masses of a grey colour, and are supposed to be fossil excrement of animals, or occasionally concretions around bones, amongst which are found fish-teeth and some vertebræ. Either from the exhaustion of the better sorts or from imperfect washing the quality has lately somewhat deteriorated, and there is now some difficulty in making superphosphate from them to contain more than 25 per cent of soluble phosphate.

The following tests were made before this deterioration :—

	1.	2.	3.	4.	5.
Tribasic phosphate of lime	60·87	58·52	27·12	54·89	57·09
Carbonate of lime ..	18·25	12·47	11·66	15·13	13·27
Oxide of iron and alumina	5·30	3·49	4·44	3·82	3·24
Fluoride of calcium ..	1·80	2·20	3·00	4·00	4·33
Insoluble silicious matter	6·50	6·04	6·22	8·64	6·93

These coprolites are extracted by washing from a stratum not more than 1 foot thick. An average yield is 300 tons per acre, and sometimes enormous prices are paid (up to £300 per acre) for the privilege of digging them. In making contracts for superphosphates it has hitherto been a very common practice for buyers to stipulate for them to be made from Cambridge coprolites only.

Coprolites are also raised in Suffolk, Bedfordshire, and Buckinghamshire, in England; also, largely in France and in Russia; but these all contain much iron or silica and other impurities, which reduce the quantity and depreciate the value of the phosphate of lime in them. It is chiefly from the neighbourhood of Boulogne, in the North of France, that the French coprolites are sent over to England, and these are largely used for mixing with richer descriptions of phosphates. They occur as dark grey nodules, larger than those from Cambridgeshire, and are rich in organic remains. An excessive quantity of silicious matter is their chief impurity, and the cause of the low percentage of phosphate of lime, which seldom exceeds 45 per cent.

Analysis of Boulogne Coprolites.

	1.	2.	3.
Triphosphate of lime ..	46·45	48·0	43·3
Carbonate of lime	11·93		
Iron and alumina	7·29	20·00	22·9
Fluoride of calcium	2·08		
Insoluble silicious matter	23·56	28·1	28·2

There are also coprolite beds in France, in the Valley of the Rhone near Switzerland, and in the Ardennes near to Belgium, where it is thought worth while to go nearly 200 feet deep through an argillaceous clay to obtain them; but the cost of carriage is too great to allow them to be exported from these places to England.

Suffolk Coprolites are found adjacent to the London Clay, and consist chiefly of rolled pebbles, with a small proportion of more or less perfect specimens of bones of various animals, as also some fish and Crustacea. They were formerly regarded as fossilised excrements of animals, for which reason they were called coprolites; but they are now supposed to be calcareous pebbles which have undergone a peculiar change, and become impregnated with phosphoric acid by long-continued contact with decaying animal and vegetable matter.

The name pseudo-coprolite has been given from their resemblance to the Cambridge coprolites, but they are distinguished from the latter by a brownish ferruginous colour and a smoother surface. They are very hard, and generally contain too much oxide of iron and alumina to allow them to be used safely in the manufacture of superphosphates.

Analyses of Suffolk Coprolites.

	1.	2.	3	4.
Triphosphate of lime..	53·4	61·3	52·5	56
Carbonate of lime ..	17·5	11·6	12·2	10
Iron and alumina ..	10·4	4·8	8·5	8
Fluoride of calcium ..	1·4	3·0	4·3	3
Insoluble matter.. ..	9·7	10·0	12·2	12

Wicken, Bedfordshire, and Russian coprolites (the first a poor variety from Cambridgeshire) resemble the Suffolk in their chemical character, and have the following approximate composition :—

	Bedfordshire.	Wicken.	Russian.	
			1.	2.
Triphosphate of lime..	50	36	33	48
Carbonate of lime ..	8	10	5½	
Iron and alumina ..	8	12	6	12
Fluoride of calcium ..	4	2	3½	
Insoluble matter.. ..	20	28	43	30¼

South Carolina or Charleston Phosphate stands next in importance to Cambridge coprolites as raw material for manure-making. This is found in the calcareous strata of the Charleston basin, occupying an irregular area of 50 or 60 miles, and partly underlying the city of Charleston. It consists of irregular-shaped nodules, associated with fossil bones of marine and land animals which are found embedded in a stratum of clay and sand about 2 feet thick. There are two kinds, the land and the river deposit. The former is of a fawn-colour, and easily ground, but there is some difficulty in washing away all adhering clay, &c., and it is chiefly kept for home use. The river phosphate has become a formidable rival to Cambridge coprolites, and in some respects it is found to be superior to our native mineral. It is dark, almost black in colour, and rather harder than the land variety, and, notwithstanding that it makes a very dark-coloured superphosphate, it is very much liked by manufacturers. It is dredged from the rivers, and the mud and sand are washed away on board of the dredgers.

The following represents approximately the composition of the river phosphates :—

Triphosphate of lime	54
Carbonate of lime	14
Iron and alumina	3½
Fluoride of calcium..	2½
Insoluble silicious matter	15

As compared with Cambridge coprolites, this mineral is more easily dissolved, and a greater portion of the phosphates is rendered soluble, but it takes longer to grind, and the millstones are more quickly worn. The mineral known as –

Lot or Bordeaux Phosphate comes from the Departments of Lot and Lot et Garonne, in France. It occurs in pockets or fissures and veins of the limestone, and also in thin layers, near the surface. These are covered with an alluvial soil and clay, containing phosphates, but much contaminated with iron and other impurities. The pockets, of all shapes and sizes, and sometimes reaching 100 feet deep, are generally traced and indicated by narrow vertical veins of deposit, which rise from them to the surface, and are mostly found on the highest ground. It varies greatly in appearance, texture, and composition. Occasionally it is found in snow-white compact masses, breaking with an earthy fracture, and of a moderate degree of hardness. The more ordinary kinds are of a dark yellow or brown, dense, and hard; but it is frequently found of a dark agate colour, somewhat resembling the inside of broken flints, of a waxy lustre, stratified and intersected with thin layers of oxide of iron. It has the appearance of being an aqueous deposit; and the probabl

cementing together of lumps of phosphates, bones, &c., with more or less alluvial clay and earth, by the percolation of dissolved phosphatic matter, may account for the appearance, texture, and composition of some portions. The white specimens are generally the richest, some being as high as 85 per cent, with a minimum (½ per cent) of iron, &c., but the bulk of cargoes received here only contain 70 to 72 per cent, and with 4 or 5 per cent of iron, &c. Fossil bones and teeth are found in quantity. The surface phosphatic earth finds a ready sale on the spot.

Analyses of Two Sample Parcels of Lot Phosphate.

	Best Quality.	Poor Quality.
Triphosphate of lime	67·19	55·45
Carbonate of lime	15·31	8·30
Iron, alumina, fluorides, &c.	4·20	12·86
Silicious matter	5·20	19·13

The best varieties of these phosphates are well adapted for the manufacture of superphosphate. Most of the large Lot mines are owned and worked by English firms, amongst which is a Newcastle Company.

To be continued.)

NOTICES OF BOOKS.

Treatment of Ores. By Thomas Clarke, M.D., and Edward Smith, F.C.S. Torquay: Directory Office.

This pamphlet is an account of a patent granted to the authors, No. 4448, December 26, 1874. The patentees claim, in addition to improved methods of concentrating the ores and of applying a hot or cold blast in roasting and "chlorodising" the employment of alkaline hyposulphites and of ammonia separately or jointly for the solution of the metals, an improved method of separating silver, the use of superheated steam if hyposulphites alone are used, and the passing of galvanic currents to aid the galvanic action, and the mixing with the solution any requisite quantity of powdered copper precipitate. There are also a number of improvements in the construction of the working plant.

Chemical Analyses and Commercial Values and Prices of Fertilisers Sold in Georgia for the Season 1875-76, to which are Appended Formulæ for Composting Fertilisers at Home, and Reports of Experiments. Published under the Direction of the Commissioner of Agriculture for the State of Georgia.

The nature of this pamphlet will be easily understood from its title. The fertilisers, or manures as we should call them, met with in commerce in Georgia, have been analysed by Mr. W. J. Land, chemist to the Department of Agriculture, and the results tabulated. What are called the "commercial values," as contradistinguished from the "prices," are, we presume, what are in England known as "agricultural values." It will be remarked that they approach very closely to the market prices, and sometimes even exceed them. There appears to be in various parts of America a disposition to condemn chemical manures. The latter of course may be dispensed with if all the excrements, liquid or solid, of *every* being fed upon the produce of the farm can be returned without waste to the soil. Where this is not the case a deficiency in the ingredients necessary for good crops will gradually arise, and can only be compensated by the use of so-called artificial manures. We are much interested to find that in the eyes of American agricultural chemists potash takes a rank higher than it holds—or rather held—in England. Experiments made with potash salts in this country were often found in past days to give a merely negative result. The case is now different. Increased crops have been obtained by means of manures rich mainly in phosphoric acid and in nitrogen. In consequence the potash of the soil has been taken up in a relatively increased ratio, and is becoming exhausted. Hence Stassfurt salts are very naturally found to produce a beneficial effect.

A Plan for Rendering Salted Meat more Nutritious, thereby Preventing Scurvy. By R. Galloway, F.C.S. Dublin: Hodges, Foster, and Co.

The author's plan is very simple, and, as it seems to us, very feasible. He proposes to add to the meat phosphate of potash, a constituent of which it is deprived by the process of salting.

CORRESPONDENCE.

ANALYSES OF MANGANESE ORE.

To the Editor of the Chemical News.

Sir,—Dr. Phipson's last letter (Chemical News, vol. xxxiv., p. 39) is a remarkable example of argument in a circle.

I ask him how he distinguished Mn_2O_3 from a mixture in atomic proportions of MnO and MnO_2. He replies, "by determining the manganese and oxygen." I point out that such a method is inadequate, the elementary composition being the same in each case. I ask again, how he knows that his assumed Mn_2O_3 was not really $MnO + MnO_2$, and I get the reply, "because there is no MnO in the sample."

Really such an answer is childish, and an insult to the readers of the Chemical News.

As Dr. Phipson is evidently desirous of fencing with the question, and apparently has no information to impart, I am unwilling to take up space by further discussing the matter, but will ask Dr. Phipson for full and straightforward replies to the following questions:—

1. How did Dr. Phipson ascertain that MnO was not present, the method which he stated he used for the purpose having been proved quite inadequate?

2. If the determination of the total quantity of oxygen and the total quantity of manganese furnish sufficient data for the purpose, as stated by Dr. Phipson, will your correspondent inform me what proportions of MnO_2, Mn_2O_3, and MnO would be present in a sample containing 69·62 per cent of manganese and 30·38 per cent of oxygen?—I am, &c.,

Alfred H. Allen.

Sheffield, July 24, 1876.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances, de l'Academie des Sciences. No. 1, July 3, 1876.

Fermentation of Urine.—MM. Pasteur and J. Joubert.—An enquiry into the cause of the rapid formation of carbonate of ammonia in urine after leaving the bladder.

Observations on the Foregoing Communication.—M. Berthelot.—The author refers to his paper on ferments (*Comptes Rendus*, tome l., p. 1173, 1860).

Third Note on Electric Transmissions through the Soil.—M. Th. du Moncel.—Not adapted for abstraction

Metallic Nickel Extracted from the Ores of New Caledonia.—MM. P. Christofle and H. Bouilhet.—These

ores seem to belong to three distinct types—An emerald green hydrosilicate, compact and hard, containing 18 to 20 per cent of nickel and 5 per cent of water; a yellowish green hydrosilicate, more friable, and containing 12 to 15 per cent of nickel and 10 to 15 of water; a whitish blue hydrosilicate, very brittle, and easily crushed with the fingers, containing merely 6 to 8 per cent of nickel, and as much as 20 per cent of water. The metallic nickel extracted from these ores contains from 98 to 99·5 per cent of pure nickel.

Radiometer of Mr. Crookes.—M. G. Govi.—The author combats the objection raised against his theory from the fact that a radiometer surrounded by a circle of lights does not come to a stop. He argues that in a circle of candles, where the intensity of the light varies without ceasing, and where currents of air may cool the small glass case irregularly, the point of thermic equillibrium, which would stop the rotation, would only be reached with great difficulty. He maintains that a uniform temperature ought to produce continual rotation as well as a continual access of light. He describes an experiment in which a very sensitive radiometer, with discs of aluminium polished on one side, and of mica blackened on the other, and placed in a cylinder of glass, into which the steam of boiling water was passed continuously, began to turn with great velocity, the aluminium sides foremost as soon as the steam had begun to raise the temperature of the case. By-and-bye, the temperature remaining invariable, the rotation slackened, and finally stopped as long as the heat was constant. When the access of the steam was cut off the radiometer began to turn in the contrary direction, and continued so for a long time. Any radiometer may be made to turn in this direction by plunging it into a vessel of cold water. It begins to move immediately, the blackened side of the discs foremost, and only stops after a certain time, *i.e.*, when a new state of thermic equilibrium has been reached. If the instrument is then taken out of the cold water it begins to turn in the same manner as if it had been exposed to light, even though it is all the time in the most profound darkness. If for the discs of aluminium and blackened mica we substitute a set of burnt mica, blackened on one side, the phenomena are complicated, whether because of the bad conductibility of the mica, or because at a certain temperature the nacreous surface of the mica absorbs much obscure heat, and gives off more gas than the blackened side. Thus, in the case heated to 100°, this radiometer turns regularly for a certain time with the nacreous surfaces foremost, then stopped, and began to turn in the contrary direction. The author then describes some unsuccessful attempts made to eliminate the gases adhering to the discs.

Explanation of the Movement of the Radiometer by the Aid of the Theory of Emission.—M. W. de Fonvielle.—The blank surface which reflects the light, and behaves like an elastic surface, ought to be more energetically repelled than the black if the luminous molecules act like masses striking the surfaces of the radiometer. But this principle supposes that the speed of the shock is not superior to the speed of the propagation of molecular movements, which latter is less than that of a ball proceeding from a revolver. This applies *a fortiori* to the shock produced by the luminous molecules, whose speed is a thousand times greater than that of a bullet. In this case, therefore, the absorbing or obscure surfaces should be repelled.

Radiometer of Mr. Crookes.—M. E. Ducretet.—The radiometer being exposed to ordinary daylight, its discs take a movement of direct rotation, the black surfaces being repelled. If ether is poured upon the case the movement is stopped, and then re-commences in an opposite direction. This reaction soon ceases, and we see the discs resume the original direct movement, in spite of the evaporation on the glass case, kept up by a gentle sprinkling with ether. At this moment the rotation becomes more rapid than at first, the evaporation seeming to act as if it were a source of heat, and yet the fall of temperature caused by the evaporation of the ether is very distinct. As soon as the application of ether ceases the movement resumes its normal speed, and remains direct. To repeat these experiments it is necessary to wait till the interior temperature of the radiometer has become equal to that of the surrounding air. The author has exposed a radiometer fixed in a dark place to the action of some tubes filled with phosphorescent powders, rendered very luminous by a previous exposure to the sun. There was no movement. The author is constructing a radiometer in which the reflecting surfaces are covered with very phosphorescent powders, whilst the other surfaces are blackened.

New Battery with Peroxide of Manganese.—M. G. Leclanché.—Not adapted for abstraction.

Action of Hydracids upon Selenious Acid.—M. A. Ditte.—With dry hydrochloric acid gas the result is a compound, SeO_2HCl. It is a liquid of a pale amber colour, and is capable of absorbing more hydrochloric acid, forming a solid crystalline body, $SeO_2,2HCl$. Selenious acid absorbs hydrobromic acid very greedily, forming a mass of steel-grey crystals, composed of—

$$SeO_2,2HBr.$$

Decomposition of Insoluble Carbonates by Sulphuretted Hydrogen.—L. Naudin and F. de Montholon.—Carbonate of baryta suspended in water is completely converted into sulphide of barium by a sufficiently prolonged current of sulphuretted hydrogen. With other insoluble carbonates experimented upon the transformation is equally complete.

New Method of Substitution of Chlorine and Bromine in Organic Compounds.—M. O. Damoiseau.—The author makes use of a peculiar animal charcoal, prepared according to the method of Bussy, by calcining a mixture of dried blood and carbonate of potash. When cold it is carefully lixiviated, and calcined again at the highest possible temperature. The compounds studied have been formed in the pores of this charcoal.

Synthesis of Allantoin.—M. E. Grimaux.—The synthesis of allantoin and that of parabanic acid realise the synthetic reproduction of all the derivatives of the parabanic group.

A New Butylic Glycol.—M. Nevolé.—Not adapted for abstraction.

New Alcoholometric Method by the Distillation of Alkalinised Spirituous Liquids.—M. E. Maumené.—Measure at + 15° C. 200 c.c. of the spirituous liquid in question, brought if needful to 14 or 15 per cent of alcohol at most; neutralise this volume with caustic soda in slight excess; distil this liquid to the half or 100 c.c., also at + 15°, and measure the alcohol by means of a good centesimal alcoholometer. If this liquid, examined with two drops of litmus or with turmeric paper, appears to contain an appreciable quantity of ammonia it is neutralised with a few drops of water, and the 110 to 120 c.c. made up by the washing-waters are distilled down to 100 c.c. at + 15°. The alcoholometer on immersion into this liquid gives its exact percentage of alcohol.

Detection of Magenta in Wines.—M. E. Jacquemin.—The author dyes wool with an ethereal extract of the colour separated from the wine by means of agitation with ammonia and ether.

On Nitralizarin.—M. A. Rosenstiehl.—The author admits that this compound was first produced by Mr. W. H. Perkin.

Moniteur Scientifique, du Dr. Quesneville, July, 1876.

Review of Physics.—M. R. Radau.—This consists of notices of the coefficient of dilation of the air; on electric and thermic conductivity; on new pyrometers; on Stoney's new spectroscope; on the measurement of the refractive indices of liquids: and on the relative value of metals

Vanadium, we find, is stated to be worth 28,680 francs per kilo., or, in round numbers, seven times as much as gold.

Action of Ammonia and the Compound Ammonias upon the Phospho-platinous and Phospho-Platinic Chlorides.—M. G. Quesneville.—Not adapted for abstraction.

Researches on Viscous Fermentation.—M. A. Commaille.—The continuation of a lengthy treatise.

Resorcin, and its Different Methods of Preparation.—M. F. Reverdin,—Reserved for insertion in full.

Colouring Matters Derived from Resorcin.—M. L. Durand.—Reserved for insertion in full.

Use of Alkaline Sulphides in Dressing Hides.—A. Gelis.—The author points out that the use of alkaline sulphides in removing the hair from hides represented as a recent German invention is really due to MM. Boudet and Domminge, who took out a French Patent for the process as early as 1838.

Importance of Sulpho-carbonates as a Remedy for the Phylloxera.—(Extract from a report read April 25, at the session of the General Council of Saône et Loire.)—The writer maintains that the sulpho-carbonates, though successful in small experimental operations, have proved a failure when tried upon a practical scale.

New Volumetric Process for the Determination of Astringent Matters.—M. F. Jean.—Already noticed.

Freezing Machines with Sulphurous Acid.—M. Raoul Pictet.—This paper is, in a great measure, modelled upon the section on artificial cold in Dr. Hofmann's *Berichte*, which appears in the Chemical News.

Bulletin de la Société d'Encouragement pour l'Industrie Nationale, No. 31, July, 1876.

This issue contains nothing of scientific interest.

Les Mondes, Revue Hebdomadaire des Sciences, No. 10, July 6, 1876.

This issue contains no chemical matter.

No. 11, July 13, 1876.

The Abbé Moigno writes:—Having studied the radiometer made by MM. Alvernnat Frères, I am inclined to believe that the movement must be ascribed to an effect of reaction exercised by the gas which, first absorbed by the blackened surface of the discs, is disengaged in darkness, re-absorbed under the influence of light, again evolved, &c. He connects the phenomena of the radiometer with the attraction and repulsion exerted by light upon plants.

Experiments on the Combustion of Organic Matter under the Double Influence of Heat and Oxygen.—M. Désiré Loiseau.—An interesting paper, which would be of little value except accompanied by the needful illustrations.

MISCELLANEOUS.

University of London.—The following is the List of the candidates who have passed the recent first B.Sc. examination:—*First Division*: A. Black, private study; T. Bolton, University College; E. H. Cook, Royal College of Science, Dublin; R. H. Cotton, B.A., Owens College; A. Cutfield, Epsom College; A. W. Dallmeyer, University College; W. Fisher, B.A., private study; W. Fream, Royal College of Science, Dublin; T. Gough, private study; W. H. Higgin, Owens College; E. Hopkinson, Owens College; W. E. Hoyle, Owens College and Christ Church, Oxford; G. W. Mackie, B.A., private study; H. Major, B.A., private study; H. F. Morley, B.A., University College; M. F. O'Reilly, St. Joseph's College, Clapham; J. A. Owen, private study; J. H. Paul, private study; J. M. Raby, B.A.; Owens College; H. L. T. Sack, B.A., private study; R. K. Sen, Edinburgh University; G. Severs, private study; J. Shirley, private study; T. B. Silcock, private study; G. T. Smith, private study; J. Stephens, University College and private study; T. E. Vasey, private study; W. L. Wills, Owens College; J. T. Wright, private study; R. B. Yardley, University College. *Second Division*: A. Atmaram, University College; B. Borrah, University College; W. K. Griffin, University College; E. J. Hodges, private study; T. Isherwood, Owens College and private study; M. Knowles, private study; L. Larmuth, Owens College; W. Palmer, University College; J. Runciman, private study; B. J. Snell, B.A., New College; J. Trubert, St. Joseph's College, Clapham; H. W. Turner, University School, Hastings, and private study; H. Ullyett, private study; J. B. Wohlmann, B.A., private study.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

Improvements in the treatment of human excreta, and in the manufacture of manure therefrom, and in the apparatus employed therein. F. G. Whitwham, Cannon Street, London. (A communication from F. A. Bonnelin, Island of Mauritius.) April 2, 1875.—No. 1195. This invention relates to the treatment of human excreta, and to the production of manure therefrom, and consists of a peculiar process of and apparatus for effecting the deodorization or disinfection of the solid and liquid portion together, and of the liquid portion separately, in order to fix the salts and gases, and render the excreta capable of being employed as a manure for agricultural purposes.

An improved method of and apparatus for treating fecal matters so as to destroy their noxious qualities and to obtain useful products therefrom. W. E. Newton, Chancery Lane, Middlesex. (A communication from A. Sindermann, Breslau, Germany.) April 3, 1875.—No. 1210. The fecal matters are first subjected (under great heat) to distillation, and thus are separated into their solid and gaseous or volatile parts. Whilst the solid matters remain behind in the retort, he volatile or gaseous parts pass through a tube into a vessel in which the tar is deposited, and from thence they pass into other parts of the apparatus, and are at last converted into illuminating gas.

Improvements in the composition and manufacture of bituminous and other compounds, and in the application of such compounds to paving and other purposes. G. Clark, Craven Buildings, Drury Lane, Middlesex. April 5, 1875.—No. 1230. (1) The production and manufacture of a bituminous compound, having asphaltum as its base, and in blocks similar in character to native rock asphalte, and designated in the Specification as asphaltum mastic and complete mastic, which may be easily heated in a copper, and readily used when so heated for paving or other purposes. (2) The combination of wood with asphaltum or any other bituminous or other plastic compound in the form of blocks for paving purposes, composed of any such bituminous or other plastic compound contained in a wooden box or frame or part of a frame, forming an outer casing, wholly or partially, to the said block, and laid down as paving in the manner described in the Specification. (3) The use of sawdust or any vegetable particles of fibre, wool, or hair as part of the materials, separately, or any one of them mixed with one or more of the others, in any bituminous compound made as described in the Specification for paving or other purposes.

Improvements in the manufacture of sugar. A. V. Newton Chancery Lane, Middlesex. (A communication from F. O. Matthiessen, New York, U.S.A.) April 5, 1875.—No. 1234. The contents of the vacuum pan (consisting at this stage of the manufacture of crystal deadening medium (syrup) are run out through a cock or valve in the bottom thereof into a separate vacuum chamber where a further concentration is effected before submitting the sugar to the clarifying operation.

Improvements in the preparation of oil to be used with colours. M. Zagler, Buckland Crescent, Belsize Park, Middlesex. April 8, 1875.—No. 1276. Castor oil or other non-drying oil to be mixed with varnishes or dissolved gums is prepared by heating the oil with a small proportion of anthracen, or by boiling it without heat a small quantity of tetrachloride of carbon. Linseed oil or other drying oil is prepared in a similar manner, so that it may mix without heat with varnishes or dissolved gums; or linseed or other drying oil to be mixed with varnish is prepared by dissolving rosin in the oil by means of heat, and turpentine or methylated spirit are then added.

Improvements in treating and refining tallow and other fatty substances. R. Lavender, Kircaldy, Fife. April 9, 1875.—No. 1291. This Provisional Specification describes melting tallow, and mixing it with naphtha; when cold it is bagged and subjected to pressure, by which the oily matters and solvent are expressed.

Improvements in the treatment of sulphur ores. A. A. Croll, Coleman Street, London. April 10, 1875.—No. 1396. The object of the invention is to subject ores containing sulphur to a certain degree of heat obtained by the passage of atmospheric air through charcoal, coke, or other carbonaceous matter in the state of ignition. For this purpose the chamber for the ignited carbonaceous matter is in direct communication with one, or it may be several, close chambers containing the sulphur ore to be acted upon. To facilitate the action of the heat upon the latter, such ore is previously broken up into comparatively small particles, and these are supported on grating or retemate work, the openings through which are close enough to prevent the particles of ore passing through, while they yet admit of the free passage of the fluid sulphur obtained by the action of the heat.

Improvement in the manufacture of [illegible] and in apparatus employed therefor. W. F. C. S. Curtis, Belfast, Antrim, Ireland. April 12, 1875.—No. 1381. The manufacture and purification of aerated waters free from metallic [illegible] or other impregnation, and the [illegible] and apparatus and vessels therefor, consist mainly or in part of glass, china, delft, porcelain, clay, earthenware, pottery, agate, flint, marble, or other stone, cement, alabaster, enamel, glaze, platinum, gold, silver, ivory, bone, horn, ebonite, vulcanite, india-rubber, gutta-percha, asbestos, leather, hide, wax, shellac, resin, catgut, teak, cork, ebony, lignum-vitæ, oak, hornbeam, or other wood, paper, or other plastic material, or of a combination of the same, which may be imbedded or enclosed within, or contain, or be supported by, metal or a combination of metals, or be used for coating or plating the apparatus or vessels heretofore employed.

Improvements in the manufacture of alkali. H. Gaskell, Widnes, Lancaster. April 12, 1875.—No. 1387. This invention relates to that stage in the manufacture of alkali in which black ash is made in revolving furnaces: consists in first charging the furnace either with salt-cake and a portion or the whole of the "slack," or with salt-cake alone, and when the salt-cake has "fluxed" or "softened," so that it occupies less space in the furnace, adding the remainder of the charge.

Improvements in the manufacture of candles. P. Lomordon, Sydenham Park, Kelmak. April 12, 1875.—No. 1388. To the extent I make use of tallow by preference the soap made according to an improved process for which I have obtained Letters Patent, dated October 27, 1874.

Improvements in the treatment of sewerage with a view of extracting the fertilising products therein contained, and in the apparatus employed for that purpose. W. Morgan-Brown, Southampton Buildings, London. (A communication from G. F. Harding and J. R. Johnson, Rue Gaillon, Paris.) April 13, 1875.—No. 1395. This invention describes the extracting fertilising products from sewerage by allowing the liquid to flow in wide and shallow currents over a very slightly inclined surface: the tendency of this arrangement is to cause a rapid settlement of the solid matter, which is removed or dried by currents of air.

Improvements in apparatus to be used in disinfecting linen and bedclothes, and the walls, ceilings, and floors of rooms, and for other like purposes. J. Teychenné, Birmingham, Warwick. April 13, 1875.—No. 1337. This invention consists of a pan or vessel, portable or fixed, divided by a vertical division into two compartments, one compartment consisting of a closed vessel in which the disinfecting vapour or gas is volatilised or generated, and the other compartment consisting of an open vessel or chamber for receiving the linen or bedclothes to be disinfected. The bottom of this chamber is charged with the disinfecting material, and the linen or clothes are laid upon a perforated partition. By the application of heat to the bottom of the apparatus the disinfecting material is volatilised in both chambers, and by the action of the vapour or gas directly generated in the clothes-chamber, and that conveyed to it under pressure from the other chamber, the clothes or linen are thoroughly disinfected. By means of a flexible pipe on the top of the closed vessel or chamber the disinfecting vapour or gas may be directed upon walls, ceilings, and floors of rooms, or other surfaces it is wished to disinfect.

A new method for removing the incrustation from boilers of steam engines, for prevention of successive incrustations, and for the preservation of the metal. V. Felice, Rome, Italy. April 14, 1875.—No. 1343. At the time steam is to be got up the following specific is to be introduced into the boiler through an aperture in its upper part. 1 kilo. of japan earth (that is to say, catechu); 50 grms. of sal ammoniac; 75 grms. of sumach, the whole forming the quantity for each ten horse-power engine.

Improvements in the purification of water and other fluids. T. Spencer, Euston Square, London. April 15, 1875.—No. 1368. The object of this invention is to consolidate granular magnetic carbide (used for the purification of water) into solid but porous magnetic blocks of any shape by treatment in an oven in mixture with flour, and then by increasing the heat to give the same coherence sufficient to render them applicable for portable or fixed filters. The means employed are also applicable to the consolidation of any ferruginous oxide or ferruginous refuse, and applicable to similar purposes.

Improvements in [illegible] fabrics, paper pulp, and other articles. F. Wirth, Frankfort-on-Main, Germany. (A communication from V. V. Baerle, Worms, Germany.) April 13, 1875.—No. 1382. I lay the article to be bleached first in a cold solution of silicate of soda. After the operation the article is pressed out. The material is then worked with cold water, and placed in a weak solution of chloride of lime. The stuff is bleached in weak hydrochlorite of lime.

Improvements in the treatment of that preparation of india-rubber commonly called vulcanite. W. C. Henderson, Pownall Road, Dalston, Middlesex. April 17, 1875.—No. 1404. The object of the invention is to obtain various coloured effects in vulcanite. India-rubber is combined with colour to the depth of colour or tint desired, and to the combination obtained is added sulphur as may be required for the purpose of the conversion of the india-rubber, and having regard to the action of the sulphur on the colour. The compound obtained is then cured and ground to reduce it into particles of the size required. These particles are then mixed with the dough of ordinary vulcanite in proportions varying with the effect desired to be produced, and then formed and cured. By these means effects are obtained very much resembling granite and other stones or marbles in appearance.

Improvements in the mode of and apparatus for treating fibres for the manufacture of paper. T. H. Gray, Grant Road, Clapham Junction, Surrey. April 17, 1875.—No. 1412. I cut up straw, bamboo, or other substances into lengths, say of 1 inch more or less, and subject the cut material to the action of [illegible] contained in a fixed cylindrical case, a metal [illegible] and at its [illegible] with steel bars or blades. The materials are then submitted to a boiling process, with the addition of chemicals to [illegible] the fibres to pulp.

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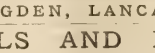

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THE CHEMICAL NEWS.

Vol. XXXIV. No. 872.

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 45.)

Chlorine, Bromine, Iodine, and Fluorine.
By Dr. E. Mylius, of Ludwigshafen.

The use of Weldon's process is decidedly increasing. In the beginning of 1874 the annual produce in England on this system was 50,800,000 kilos. chloride of lime, and plant for the further production of an equal quantity was in the course of erection, whilst the previous annual production on the old system did not exceed 91,440,000 kilos. In Germany the "Silesia" establishment at Saarau has carried on Weldon's process with advantage for several years. In Belgium, according to Mr. Weldon's account, the works at St. Marie d'Oignies, near Charleroi, have introduced the process. In France the same step has been taken by the St. Gobain company, whilst Kuhlmann,† Merle, and other manufacturers are preparing to adopt the new method. In Saarau, where, as already mentioned, Weldon's process has been in operation for some years, it is carried on exactly as above described. The consumption of lime for the regeneration of material for 100 kilos. of chloride of lime is 70 to 75 kilos. inclusive of the sediment which becomes useless in preparing milk of lime. To regenerate enough for 2500 kilos. chloride of lime air is forced in for five to five and a half hours, and from 75 to 80 per cent of the manganese present is converted into peroxide. The air-pump employed works with 45 horse-power, and has a cylinder of 7·32 c.m. in diameter, and 94·16 in height. The piston makes 40 strokes per minute. The loss of peroxide of manganese at Saarau amounts to about 10 per cent (von Kulmitz).

The above-described process for the regeneration of manganese residues has one deficiency. A portion of the hydrochloric acid is used to saturate the lime of the calcium manganite, and both lime and hydrochloric acid are generally allowed to escape in the almost worthless state of chloride of calcium. To obviate this defect Weldon has planned a modification of his process which renders it practicable to obtain as much as 62 per cent of the hydrochloric acid employed in the form of free chlorine, whilst only a small quantity of chloride of calcium is formed as a by-product. He attains this result by decomposing the manganese solution not with lime, but with magnesia. For this purpose the process is modified as follows:—The liquid derived from the evolution of chlorine out of magnesium manganite, containing chloride of magnesium and manganese, is evaporated at first in a pan and then in a kind of muffle, whilst a current of air is constantly passed through. Towards the end of the evaporation the chloride of magnesium under the influence of watery vapour yields hydrochloric acid, which is condensed. After the liquid has been evaporated to a certain consistence the salts are drawn upon a hearth, where they are roasted in a current of air. Here chlorine is evolved, diluted with air, and is combined with milk of lime in a scrubber, whilst manganite of magnesium remains behind. The latter is then used with hydrochloric acid for the development of chlorine, and passes again through the same rotation as a mixture of chlorides of magnesium and manganese. The hydrochloric acid, which is given off about the end of the evaporation, is exactly sufficient to evolve concentrated chlorine from the solution of chloride of lime, into which the diluted chlorine obtained by roasting the residue from the evaporation has been transformed. Hence only that part of the hydrochloric acid is lost which is consumed in decomposing the hypochlorite of lime, whilst 62 per cent of the chlorine which enters the process in the form of hydrochloric acid is utilised in the free state. In this manner it is possible to obtain 1000 kilos. chloride of lime with the hydrochloric acid evolved from 700 kilos. of common salt. The magnesia and manganic oxide are not consumed, but merely play the part of transferrers of oxygen.

Preparation of Chlorine according to Deacon.—If Weldon has succeeded in preparing chlorine from hydrochloric acid in a continuous process without, theoretically at least, requiring more than one initial charge of native manganese, the problem of converting hydrochloric acid into free chlorine, without the formation of any by-products, has been much more completely solved by Deacon.

It has been long ago proposed to utilise for the manufacture of chlorine the well-known property of cupric chloride to be decomposed on heating into chlorine and cuprous oxide, which latter in a current of air yields copper oxychloride; but the experiment was never carried out on the large scale. The same applies to the fact, likewise long ago known, that hydrochloric acid mixed with air and passed over ignited porous bodies is partially converted into chlorine and water. Deacon has succeeded in founding upon the combination of both these reactions a process which enables us to obtain chlorine continuously without the formation of any troublesome residues whatsoever.

(To be continued.)

* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzeends."

† On September 18, 1874, I found in the establishment of M. Kuhlmann no preparations for the introduction of Weldon's process.—A. W. H.

MINERAL PHOSPHATES AND SUPERPHOSPHATE OF LIME.*

By WALTER C. REID.

(Concluded from p. 50.)

German or Nassau Phosphate, deposited, like the Bordeaux variety, in pockets, is found chiefly in the neighbourhood of the rivers Lahn and Dill, in Nassau. Some of it is of a yellow colour, breaking with an earthy fracture; other portions have the appearance of pieces of phosphate, cemented together with ferruginous clay, and in rare cases it appears in a crystalline form. The richest varieties are of a light yellow colour, and tolerably free from iron, &c.; but the predominating lower qualities are contaminated with much iron ore, clay, limestone, &c.

Analysis of German Phosphates.

Triphosphate of lime	58 to 65 per cent.
Carbonate of lime	5 to 8 ,,
Iron and alumina	10 to 15 ,,
Insoluble matter	10 to 12 ,,

From these phosphates there is no difficulty in making superphosphate quite dry, but they invariably set extremely hard, and they therefore require much breaking up. Very few cargoes of German phosphates arrive in this country now.

Spanish and Portuguese Phosphorites generally go under the name of Estremadura phosphate, from the province in Spain where it is chiefly found. It is hard, of light yellow colour, crystalline structure, and generally more or less mixed with quartz, and becomes phosphorescent when heated. It is tolerably free from iron and alumina, but

* A Paper read before the Newcastle-upon-Tyne Chemical Society.

contains variable and often considerable quantities of fluoride of calcium.

The following are some analyses of Estremadura phosphate :—

	1.	2.	3.	4.
Triphosphate of lime..	72	78·7	72·6	80·6
Carbonate of lime ..	9	Nil.	Nil.	4·2
Iron and alumina ..	3½	8·8	5·1	2·0
Fluoride of calcium ..	3½			
Insoluble matter.. ..	4	11·4	18·3	12·3

In dissolving, from 30 to 33 per cent of the phosphates in the superphosphates is rendered soluble; but, owing to the small quantity of carbonate of lime in the mineral, the superphosphates when first made are generally dense and damp, and require some time to get into good condition.

Norwegian and Canadian Phosphates.—Under the name of apatite, we import from Norway and Canada small quantities of phosphatic minerals, obtained from veins in the primitive rocks. They are hard and crystalline, of vitreous lustre, and of various shades of colour, white, yellowish white, and greenish white. According to Voelcker, the Norway apatite contains no fluoride of calcium, but the Canadian a great deal. Neither contain any carbonate of lime, and only a little iron and alumina. Some parcels have tested above 90 per cent of phosphate of lime, but on an average they do not exceed 75 per cent. The following analyses represent the best qualities :—

	Norway.	Canada.
Triphosphate of lime..	90·74	91·20
Iron and alumina	2·00	,,
Fluoride of calcium	,,	7·60
Sand, &c.	1·64	0·90
Chloride of calcium	1·61	0·78

The apatites are the only mineral phosphates that contain an appreciable quantity of chloride of calcium. In one kind, from Snarum, in Norway, the fluoride of calcium is, to a great extent, replaced by chloride of calcium, thus :—

Triphosphate of lime	91·13 per cent
Choride of calcium	4·28 ,,
Fluoride of calcium	1·59 ,,

From apatites alone it is difficult to make dry and powdery superphosphates; but, by mixture with weaker phosphatic minerals that contain more carbonate of lime, they work very well indeed.

Guanos.—As non-nitrogenous guanos, we receive phosphatic materials from the West Indian Islands. These are called Sombrero, Navassa, Malden, and Curacoa, after the islets from which they are taken, and they are distinguished from the Peruvian, Mejellones, and Ichaboe kinds by the almost entire absence of ammonia, by the small quantity of organic matter, and by the large proportion of insoluble phosphates which they contain.

Sombrero rock or crust guano was at one time largely imported into England, but at the present time very little arrives in this country. It is quarried on Sombrero, one of the group of the Leeward Islands in the Caribbean Sea; an islet about two and a half miles long, three-quarters of a mile wide, and not more than 20 or 30 feet above the level of the sea, and which is entirely composed of this phosphatic substance. Fragments of bones are found in the rock, and it is supposed to be a breccia of bones of turtles and other marine vertebrata, coral *debris*, &c., collected before the elevation of the islet above the water, and cemented together since by the droppings of birds carried down through the mass by rains.

It varies in colour and texture, some being porous and friable, whilst other specimens are dense and compact. Recent importations have contained less iron and alumina and more carbonate of lime than formerly, and from this it is inferred that the rock (at present worked from under the sea) is mined in close proximity to the coral rock on which it rests.

Analyses of Sombrero Guano.

Triphosphate of lime ..	from 69 to 76	per cent
Carbonate of lime	,, 2 to 4	,,
Iron and alumina	,, 7 to 10	,,
Fluoride of calcium	,, 1½ to 1¾	,,
Insoluble matter	,, 1 to 2	,,

When Sombrero guano is dissolved by itself, it makes a high grade superphosphate of a light yellow colour.

Navassa Guano, from the coral island of that name in the Caribbean Sea, is of a reddish brown colour, and consists of globular grains of phosphate of lime cemented into hard masses, and contaminated with a good deal of iron and alumina. It is found chiefly in the cavities of the rocks which form the framework of the island.

Triphosphate of lime	from 55 to 70 per cent
Carbonate of lime..	,, 4 to 6 ,,
Oxides of iron and alumina..	,, 15 to 18 ,,
Iron and alumina (as phosphates)	,, 8 to 10 ,,
Fluoride of calcium	,, 1 to 2 ,,
Insoluble matter	,, 4 to 5 ,,

Superphosphate of lime, when made from Navassa alone, is exceedingly hard and tough, and proportionately low in strength.

Curacoa and Malden Islands both furnish guanos, but they have lately been almost entirely sold on the Continent, where better prices seem to be obtainable. In these the phosphate of lime is in an unmineralised state, and in a fine state of division, they contain but little carbonate of lime, and are almost free from oxide of iron, alumina, and silicious matter. They range in quality from 65 to 80 per cent of tribasic phosphate of lime, the average being about 70 per cent. The lower qualities are, however, almost as valuable proportionately as the higher, in consequence of there being no oxide of iron, &c., to deteriorate the product, as in the case of most of the inferior phosphates, and they are capable of yielding superphosphates of high quality.

Conversion of Mineral Phosphates into Superphosphates.—It is scarcely necessary to remark that the phosphatic materials are mixed with sulphuric acid with the object of converting the unavailable natural phosphate of lime into a state to be assimilated by plants, and, if we assume that the acid acts upon all the ingredients simultaneously, we shall probably have the following decompositions :—

(1.) Triphos. of lime + acid = biphos. of lime and sulphate of lime
(2.) Carb. of lime + acid = sulphate of lime and carbonic acid.
(3.) Fluoride of calcium + acid = hydrofluoric acid and sulphate of lime.

Hydrofluoric acid + silica = gaseous fluoride of silicium.

(4.) Oxides of iron and alumina + acid = sulphates of iron and alumina.

Sulphates of iron and alumina + biphos. of lime = { Phosphates of iron, &c. / Sulphate of lime.

There can be no doubt about the action of the acid the phosphates and carbonate of lime; nor can there be much doubt about the decomposition of the fluoride of calcium; for hydrofluoric acid and fluoride of silicium are shown to be in the evolved gases, first, by the fact that glass is etched when brought into contact with them; and secondly, by the depositing from them of pure gelatinous silica and hydrofluosilicic acid, resulting from the action of moisture upon the fluoride of silicium.

But, if the oxides of iron and alumina are converted into sulphates, it will not account for the gradual precipitation, or "going back" of some of the soluble portion of superphosphates, which continues for some time after being made.

If the acid is in sufficient quantity and powerful enough to decompose the fluoride of calcium, it seems strange that it should not also dissolve the iron and alumina; but the most probable way to account for "reduced phosphates," is to suppose, that, a portion at any rate, of

these remain as uncombined bases, to act as precipitants of the soluble phosphates.

After selecting a mineral by its chemical composition, the next thing is to consider its density or porosity, and the facility by which it can be reduced to a fine powder, and acted on by acid. It is impossible, in practice, to render the whole of the phosphate of lime soluble, and the proportion left undissolved, and depending upon the state of aggregation of the minerals, varies from 10 to 26 per cent of the total phosphates in the superphosphate.

In almost every case it is requisite to dry the phosphates before grinding, and to have powerful machinery to reduce them to powder. After drying they are crushed in mills or stone-breakers, then ground fine under French burr stones, and riddled. The quantity that can thus be prepared depends very much upon the hardness of the mineral, and the arrangement of the machinery and engine power; but a fair average quantity is 6 to 7 tons per mill per twelve hours. All the powder should be screened through wire gauze not less than 30 meshes to the inch.

The mixing or dissolving of phosphates in sulphuric acid is now almost entirely done by machinery. There are two kinds of mixing machines in use. One is vertical and made either of wood or metal with an upright spindle, to which are attached arms or wings for agitating, and wheel and pinion, &c., on top for turning same; the other kind consists of a long cylinder of metal or wood (or wood lined with lead) in which a stirrer revolves horizontally. Whether the mixers be vertical or horizontal they are always suspended over "Dens" (air-tight brick-built chambers), into which the superphosphate, when in a semi-fluid state, is allowed to run. The horizontal form of mixer is more generally in use, and 10 feet long by 2½ to 3 feet diameter is a convenient size, and will make about 6 tons of supers per hour. The ground materials and acid should be charged at one end, and the paddles or agitators should be so arranged as to work the mixture forward to the other end to be discharged.

It is advisable to feed the powdered phosphates into the mixing apparatus by means of elevators working by machinery, as in this way it is supplied much more regularly that when done by hand, and it is important that the supply of the two materials (phosphates and acid) should be at the same rate and finish together.

The acid employed should not be under 1·5 or above 1·6 sp. gr., and when new kinds of phosphates have to be dissolved, it is better to ascertain the quantity of acid that they will carry by a series of actual experiments with moderate sized batches rather than depend upon theoretical calculations based upon analysis of the mineral.

Some of the phosphates take their own weight of acid of 1·55 sp. gr., but the majority of them require rather less. It varies from 80 to 100 for each 100 of mineral. During the incorporation of the two materials irritating vapours are given off, and these are generally conveyed by a special flue to a condenser, or in some cases through a lime purifier, before being allowed to pass into the atmosphere. After remaining twenty-four to thirty-six hours in the "Dens," the superphosphate is taken out, and either stored for future or riddled for immediate use. If good, it should be light and porous, and easily crumbled.

ON RAPID FILTRATION.

By E. C. H. HILDEBRAND.

THOUGH much has been said and written on this subject, still it does not seem to be exhausted yet, not long ago new suggestions having been made in that direction. Viewing this matter from a practical standpoint, it appears to me that we should not aim so much at the utmost gain of time in filtering and washing out precipitates, but rather at a more uniform good result of these operations. In accordance with this view, the following described apparatus will be found both convenient and effective enough to shorten the filtering process, and the drying of the filter and its contents quite considerably.

It is composed of Weil's filtering tube and Schiebler's drop aspirator, to which I have added a vacuum regulator. The filtering tube (recommended by Weil about sixteen or eighteen years ago) allows to filter under a pressure of 1 to 2 feet of water column, without any other support of the filter except the funnel itself. It allows, further, to filter into any kind of receptacle, which will be found a great convenience. On the other hand, Scheibler's drop aspirator, used as a filtering pump, is by far the most perfect one in reference to the effect produced by a given quantity of water, while its absolute effect is likewise very satisfactory for filtering purposes. The vacuum regulator is intended to prevent the rarefaction of air surpassing a certain degree.

Before entering into a more detailed description of the whole arrangement, it may be well to make a few remarks about funnels and filters.

It has been laid down, as a rule, that the sides of a funnel should have an angle of inclination of 60°, in which case a filter, folded at right angles, will fit exactly into the funnel. I found that a filter adjusted into a funnel of a more acute angle offers remarkably greater security against breaking, provided, of course, the body of the funnel approaches as nearly a perfect cone as possible. In this case the transition of the cone into the tube is marked by a distinct angle, formed by the meeting of two straight lines. The opening at the bottom of the funnel must not be too large, its diameter should not surpass ½ inch.

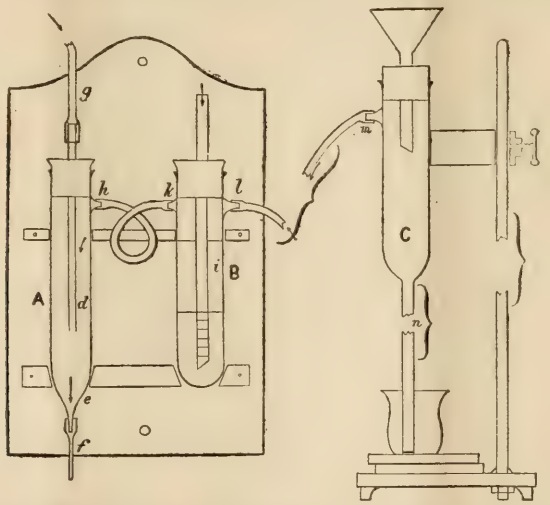
A filter inserted into a funnel of 50°, moistened and brought in perfect contact with the glass by pressing with the finger, will stand the pressure of a column of water 1½ feet high with safety. Filters supported by funnels of 30° did not rupture by the weight of a column of water 3 feet high. Funnels over 50° require the introduction of another but smaller paper filter, inside of which, and overreaching it, the main filter is inserted.

1. *The filtering tube* (see sketch C) consists of a wider upper part, carrying the funnel, and a lower narrower part, reaching almost to the bottom of the receptacle, and dipping into the filtered liquid. By rarefaction of the air in C, the filtered liquid is raised to a certain height, and thereupon results an increased pressure on the liquid in the funnel, and an accelerated filtration. The total length of the tube is 20 inches, width of the upper part 1½ inches, its length 6 inches. The narrow side tube, *m*, is 1 inch below the rim of C; internal diameter of lower part $\frac{5}{7}$ inch, its length 14 inches. The lower part must be wide enough to allow air bubbles to rise or overcome the capillary attraction exerted by the sides of the tube upon the liquid. The tube is closed by a perforated india-rubber cork, receiving the neck of the funnel, the opening of which reaches 1 or 2 inches below the little side-tube *m*. The whole is held in position by a retort-stand, burette-holder, or the like.

2. *The Aspirator* A.—Upper part 1 inch in diameter and 6 inches long, the bottom forming a cone, connecting it with the lower part, *e*, which has ½ inch internal diameter, and is 1 or more inches long. To this we attach a rubber tube, *f*, 5 or more feet long, and of the same internal diameter of ½ inch. The narrow side-tube, *h*, is 1 inch below the top of A. A perforated rubber cork, provided with a glass tube, *d*, is inserted, as seen in the sketch. This tube has $\frac{3}{8}$ inch internal diameter, extends downwards about 3 inches, upward 1 or 2 inches. To this upper end a rubber tube, *g*, is attached, destined to supply the water for the aspirator from an elevated vessel. If the flow of the water is so regulated (by means of a faucet or pinchcock) that it leaves tube *d* drop by drop, these drops falling into the narrow tube, *e*, and its continuation, *f*, perpendicularly beneath it, and, filling out its entire width, act the part of the piston in a pump, as by their motion downwards they carry with them the air enclosed in the tube between the single drops. In this way the air in A, as well as in any vessel connected with it by the communication-tube, *h*, is rarefied. The aspirator—equa

lengths of time taken into consideration—draws less air if the drops follow each other slower, but then a higher effect is produced by a certain quantity of water, whilst if the drops fall quicker the apparatus draws more air in that time, but the effect of the same quantity of water is diminished. Thus, 1 volume of water draws from 10 to 25 times its volume of air.

3. *The Vacuum Regulator* B.—After several experiments, I found a mercury valve of the construction shown in sketch B, working as well as could be wished. B has $1\frac{1}{2}$ inches or more internal diameter, and is about 6 inches long. The narrow side-tubes, *k* and *l*, are opposite each other, and 1 inch below the rim. A good soft cork, free from holes, is selected and perforated for the reception of tube *i*. The latter has about $\frac{3}{8}$ inch internal diameter, by inches in length. Its lower end is cut off obliquely, and provided with mark showing $\frac{1}{2}$ inches, and beginning at



the obtuse angle of the oblique cut. Tube B is filled up with mercury to a height of about 2 inches, then 2 inches of water are given on the top of this. The working of this valve is easily understood. By moving tube *i* downwards or upwards, its lower end is, to a larger or smaller extent, immersed in the quicksilver, and if suction is applied to one of the side tubes, the other being connected with a closed vessel, the rarefaction of air in B, and in the vessel connected with it, will reach a certain maximum degree, beyond which it cannot go: air entering by way of tube *i*, and penetrating the mercury, it maintains that status in the apparatus to which the valve has been adjusted. If the end of tube *i* is cut off obliquely, as directed, the passage of the air through the quicksilver goes on more quiet, not so eruption-like, and the supernatant water prevents entirely the spattering of the metal. Several physical causes unite to give the graduation on tube *i* only an empirical value. Under the circumstances named, $\frac{3}{8}$ inch immersion of tube *i* will create in C a water-column of about 15 inches height.

4. *The connection* of the single parts is effected by rubber tubing, which need not be of the heaviest kind, as it is not exposed to any high external pressure. Aspirator and mercury valve are best mounted on a board (as seen in the sketch), and hung in a proper place on the wall within each of the hand.

If this apparatus is to be constructed out of material on hand in every laboratory, we may take a chloride of calcium tube for the aspirator (Scheibler), and a large test-tube, or any wide-mouthed bottle, for the regulator, in which case the communication of the single parts is brought about by perforations in the corks.

In case it should be preferred to make use of Bunsen's platinum funnels, we can proceed a little different from Bunsen's method, as such an exact fit as needed in high pressure is not wanted in our case. Divide a round piece of moderately thin platinum foil, about $1\frac{1}{2}$ inches in diameter, into two equal halves, and shape them into cones, the centre of the circle forming the apex of the cone. In funnels of less than 60° the sides overlap; in funnels of 60° they meet exactly, but can even then be soldered together in one point about the middle of the cone by a grain of gold and a little borax. I cut off the point of the cone to create a small opening there, as I also perforate the sides of the cone near its apex with a pin.

Before leaving this subject I will mention, with a few words, a most simple device which I have frequently used to promote filtration, and which consists of a piece of rubber or glass tubing, about 1 foot long, fastened into the tube of the funnel when the arrangement is ready for use. The internal diameter of this tube should be, *at the most*, $\frac{1}{8}$ of an inch. A tube similar in shape to Weil's filtering-tube, but of different dimensions, looks more elegant, and meets the objection against bringing the filtered liquid in contact with india-rubber. The upper wider part is 3 inches long; the lower narrow part is made of a barometer-tube, and of the length first named. This little device meets moderate expectations very well, and will often be found a good help.

For washing out precipitates on a larger scale I use large funnels, half filled with coarse glass-powder (glass heated to redness, thrown into cold water, powdered, and the finest powder sifted off), on the evened surface of which is placed a round piece of filtering paper, in close contact with the sides of the funnel, for the reception of the precipitate. As a receptacle I use a Woolf's bottle of proper size; the filtering-pump has an evacuation-tube of 12 feet length.—*American Journal of Pharmacy.*

'THE BOOK OF THE BALANCE OF WISDOM."*

By H. CARRINGTON BOLTON, Ph.D.

THIS work is an Arabic treatise on the water-balance, written in the twelfth century, for an account of which the historian of science is indebted to the Chevalier N. Khanikoff, sometime Russian Consul General at Tabriz, an important city of Northern Persia. M. Khanikoff having obtained access, in some manner not explained, to a manuscript copy of the Arabic work, translated into the French language copious extracts, and prepared an analysis of its contents; these data, together with a transcript of the original Arabic version, he communicated to the American Oriental Society. The Society's Committee of Publication, in preparing the Russian Consul's work for their *Journal*, translated his notes into English, re-translated the Arabic extracts, and added their own valuable comments. The completed article is found in the sixth volume of the *Journal of the American Oriental Society*, pp. 1 to 128, published in 1859.

"The Book of the Balance of Wisdom" treats exclusively of the balance and of the results attainable by this instrument, which has given to modern science so many beautiful discoveries. Its exposition of the principles of the centres of gravity, of researches into the specific gravity of metals, precious stones, and liquids, shows these Orientals to have attained to experimentation, a step in the progressive knowledge of physical truths entirely unknown to the ancients.

The dedication of the work proves it to have been composed at the court of the Saljuke Sultan Sanjar who reigned over a large part of the ancient Caliphate of Bagdad from A.D. 1117 to 1157. In this introduction, the author appeals to this potentate in the following fulsome expressions of homage characteristic of the Orientals:—

"Most magnificent Sultan, the exalted Shah of Shahs, the king of subject nations, the chief of the Sultans of the world, the Sultan of God's earth . . . . the shelter of Islamism and of Muslims, the arm of victorious power . . . . Prince of Believers—may God perpetuate his reign and double his power! For his felicity is the illuminating sun of the world, and his justice its vivifying breath."

And immediately following this passage occurs mention of the date:—

"I sought assistance from his beams of light irradiating all quarters of the world, and was thereby guided to the extent of my power of accomplishment in this work, and composed a Book on the Balance of Wisdom for his high treasury, during the months of the year 515 of the Hegira of our Elect Prophet Mohammed—may the benedictions of God rest upon him and his family, and may he have peace!"

This proves the treatise to have been written in the years 1121—1122, A.D.

The authorship of the "Book of the Balance of Wisdom" is easily determined by the fortunate circumstance that the author names himself several times, "but in so modest a manner as scarcely to attract attention; instead of heralding himself at once, in his first words, after the usual expressions of religious faith, as Arab authors are wont to do, he begins his treatise by discoursing on the general idea of the balance," and then simply remarks: "*Says al-Khazini, after speaking of the balance in general*," and proceeds to enumerate the advantages of the balance which he is about to describe. Two other passages in the extracts furnished by M. Khanikoff satisfy the Oriental scholars who have examined them that the author is this self-named al-Khazini.

Attempts to identify al-Khazini with individuals of historical fame have given rise to differences of opinion, but the weight of evidence is in favour of regarding him as the same with Alhazen, the Arab optician and physiologist.

Alhazen seems to have been a native of Persia and to have resided in Spain and Egypt, but of his biography little is known. He is especially distinguished for his demonstration of the theory of vision, showing that the rays of light are reflected from external objects to the eye and do not issue forth from the eye to impinge on external things, as up to his time had been taught.

This explanation, moreover, was not based on mere hypothesis, but was the result of anatomical investigations as well as of mathematical discussions.

Alhazen also explained the astronomical refraction of light, its dependence on the variation of the density of the media traversed, and its influence in producing the phenomenon of twilight. In the discussion of all these problems he evinced true scientific greatness. He favoured the theory of the progressive development of animal forms, anticipating a doctrine but newly obtaining acceptance. Dr. J. W. Draper,* who has been our guide in this connection, says of Alhazen: "Though more than seven centuries part him from our times, the physiologists of this age may accept him as their compeer."

The name al-Khazini signifies, "related to the treasurer," which accords with his statement that the work was composed for the royal treasury.

The "Book of the Balance of Wisdom" begins with a dedication to God "the compassionate, the merciful," and a pious statement of the author's religious faith. An introduction, divided into eight sections, then follows; in the first section, the advantages and uses of the balance are enumerated in this language:—

"These advantages are:—1. Exactness in weighing; this balance shows variations to the extent of a mithkal, or of a grain, although the entire weight is a thousand mithkals, provided the maker has a delicate hand, attends to the minute details of the mechanism, and understands it. 2. That it distinguishes pure metal from its counterfeit, each being recognised by itself without any refining. 3. That it leads to a knowledge of the constituents of a metallic body without separation one from another. . . . . 4. That it shows the superiority in weight of one of two metals over the other in water, when their weight in air is the same, and reversely. . . . . 5. That it makes the substance of the thing weighed to be known by its weight. . . 6. . . . 7. The gain above all others—that it enables one to know what is a genuine precious stone, such as a hyacinth, or ruby, or emerald, or fine pearl; for it truly discriminates between these and their imitations or similitudes in colour, made to deceive."

Then follows the theory of the water balance; and in the fourth section some account of its early history and the well-known narrative of King Hiero's crown.

In the third lecture of the "Book of the Balance of Wisdom" al-Khazini describes a form of specific gravity flask, which he calls the "conical instrument of Abu-r-Raihan," and to whom he apparently ascribes the invention. Abu-r-Raihan was a distinguished Arabian astronomer, born about 970, and died 1038, A.D. He was a member of the Society of Savans founded in the capital of Kharism, and of which the eminent physician Avicenna was a shining light. He was the author of a number of works on astronomy, cosmography, and physics, one of which, entitled "The Book of the Best Things for the Knowledge of Mineral Substances," and contained in the Ayin-Akbari, or Institutes of the Emperor Akbar, treats of the specific gravity of bodies and of hydrostatic methods for determining them.

The author remarks that "the instrument is very difficult to manage, since, very often, the water remains suspended in the lateral tube, dropping from it little by little into the scale of the balance." This passage shows that Abu-r-Raihan had noticed capillary attraction; it is also certain that he understood that the size of the neck of the instrument affected the delicacy of the determinations, for

* Abstract of a paper read before the New York Academy of Sciences, May 29, 1876, and reported in the *American Chemist*.

* "Hist. Int. Devel. Europe," p. 360.

he says he would have it "made narrower than the little finger but for the difficulty of removing through a smaller tube the bodies immersed in the water."

Al-Khazini's work is made up of eight lectures, each lecture includes several chapters, and each chapter has several sections; we quote al-Khazini's own summary of his treatise as contained in the sixth section of the introduction.

"I have divided the book into three parts: I. General and fundamental topics, such as heaviness and lightness; centres of gravity; the proportion of the submergence of ships in water; diversity of the causes of weight; mechanism of the balance and the steelyard; mode of weighing with it in air and in liquids; the instrument for measuring liquids, in order to ascertain which is the lighter and which is the heavier of the two, without resort to counterpoises; knowledge of the relations between different metals and precious stones in respect to [given] volume; sayings of ancient and modern philosophers with regard to the water balance, and their intimations on the subject. This part includes four lectures of the book in their order. II. Mechanism of the balance of wisdom; trial of it; fixing upon it of [the points indicating] the specific gravities of metals and precious stones; adoption of counterpoises suited to it; application of it to the verification of metal, and distinguishing of one from another [in a compound] without melting or refining, in a manner applicable to all balances; recognition of precious stones and distinction of the genuine from their imitations or similitudes in colour. There are here added chapters on exchange and the mint, in connection with the mode of proceeding, in general, as to things saleable and legal tenders. This part embraces three lectures. III. Novelties and elegant contrivances in the way of balances such as: the balance for weighing dirhams and dinars without resort to counterpoises; the balance for levelling the earth to the plane of the horizon; the balance known as the 'even balance' which weighs from a grain to a thousand hirhams or dinars by means of three pomegranate counterpoises; and the hour balance, which makes known the passing hours, whether of the night or of the day, and their fractions in minutes and seconds, and the exact correspondence therewith of the ascendant star and fractions of a degree. This part is in one lecture."

In the seventh chapter, which treats of the "Mechanism of the Instrument for Measuring Liquids . . . and Application of it according to the Philosopher Pappus, the Greek," we find a description of a hydrometer.

"The length of this instrument, which is cylindrical in shape, measures half a hand-cubit; and the breadth is equal to that of two fingers, or less. It is made of brass, is hollow, not solid, and the lighter particles of brass are carefully turned off by the lathe. It has two bases, at its two ends, resembling two light drum-skins, each fitted to the end, carefully, with the most exact workmanship; and on the inner plane of one of the two bases is a piece of tin, carefully fitted to that plane by the lathe, shaped like a funnel, the base of which is the drum-skin itself. The instrument being thus made, when put into liquid in a reservoir or vessel, it stands upon it in an erect position and does not incline anyway."

The author then describes at length the manner of graduating the instrument, the decimal system being employed throughout. He remarks that the weight of the funnel shaped piece of tin must be varied according to the density of the water assumed as a standard. Tables of the specific gravities corresponding to the marks on the instrument accompany the detailed account of its application.

It is evident that Pappus's instrument resembled closely that of Gay-Lussac. It was, however, provided with two scales, one with its numbers increasing upwards to indicate the volume submerged in liquids of different density; the other with its numbers increasing downwards, to show the specific gravities corresponding to those submerged volumes.

The above-mentioned Pappus was an eminent Greek geometer of Alexandria, who flourished about 380 or 400, A.D. Consequently he was a contemporary of Synesius, of Cyrene (378—430, A.D.), in one of whose letters occurs what is ordinarily regarded as the first recorded mention of the hydrometer. It is certainly most interesting to find that al-Khazini's description of Pappus's instrument corresponds very closely with the statements of Synesius, a coincidence not observed by previous writers.

Synesius, "the good bishop of Ptolemais," writing to his instructress,* the fair pagan philosopher and mathematician, the ill-fated Hypatia, and being desirous of trying the wines† he is using, says:—

"My health is so delicate that I need a *hydroscope*, and I beg you to have one made for me of copper. It is a tube cylindrical in shape and of the form and size of a pipe; on its length it bears a straight line crossed by small lines, by means of which we determine the weight of waters. One end is terminated by a cone, arranged in such a manner that the tube and the cone have the same base. This instrument is called *baryllion*. If you place it in water, point downwards, it stands erect, and the divisions that cross the vertical line can be easily counted, and by this means the density of water is determined.‡"

Hoefer, the French Historian of Chemistry, in relating this statement, remarks that none of the commentators of the Letters of Synesius were able to explain the nature of this instrument until the mathematician Fermat, in answer to Castelli's request, communicated his view, correctly apprehending the principles and uses of the instrument described. This was in 1628, and now we learn that the Arabian philosophers five centuries earlier were perfectly familiar with the identical instrument mentioned by Synesius.

Al-Khazini describes several forms of balances at great length, giving details of construction and employment. One of these balances he ascribes to Archimedes; and he professes to quote the particulars respecting it from Menelaus, without, however, giving the title of the latter's work.

Another balance described by our author is that of Muhammed Bin Zakariya, of Rai; it differs from that of Archimedes by the introduction of the needle, called by the Arabs the "tongue," and by the substitution of a movable suspended bowl for the movable weight.

Finally, in the fifth lecture, he gives a minute description of the balance of wisdom according to Abu-Hatim al-Muzaffar Bin Ismail, of Isfazar. "He begins by remarking that the balance being an instrument of precision, like astronomical instruments such as the astrolabe and the zijassafaih, its whole workmanship should be carefully attended to. He next describes the beam, the front piece, the two 'cheeks' between which the 'tongue' moves, and the tongue itself." He gives the length of the beam as four bazaar cubits (two meters) and remarks that "length of the beam influences the sensibility of the instrument;" it is constructed of iron or bronze. The balance is provided with five bowls or pans, made of very thin plates of bronze, three of which have the form of hemispheres, one of which is spherical and the remaining one, destined to be plunged into water, is finished with a conical bottom. Two of these bowls bore the name of the "aërial" and were permanently attached to the beam; another pan was movable on the right arm of the beam; and the bowl intended to be immersed in water was fastened underheath the aërial bowl of the left arm; this bowl bore the name of the "aquatic," and the spherical bowl was named the "winged."

He also speaks of the mode of adjusting the balance, and of its application to the examination of metals and of

* Not in a letter of Hypatia to Synesius, as Hoefer has it in his "Hist. Physique." Paris, 1872, 12mo.

† Draper, "Hist. Int. Devel. Europe."

‡ Synesius, "Opera. Epist. XV., Lutetia," 1612, 4to, p. 174.

precious stones. Al-Khazini distinctly states that in taking the specific gravity of bodies he employed "a determined sort of water similar in density to the water of the Jaihun of Khuwarazm," and further that "we made all our comparisons in one single corner of the earth, namely, in Jurjaniyah [a city], of Khuwarazm . . . and early in the autumnal season of the year." The "Jaihun" is the modern river Oxus, and "Khuwarazm" corresponds to the modern province of Khiva.

The editor, M. Khanikoff, calls special attention to the following passages, which he considers the most remarkable in the whole treatise:—

"When a heavy body of whatever substance is transferred from a rarer to a denser air it becomes lighter in weight, from a denser to a rarer air it becomes heavier." (Lect. I., Chap. v., sec. 1.)

"Air-weight does not apparently vary, although there is actual variation, owing to difference of atmospheres. As regards its water-weight, a body visibly changes, according to the difference between waters of different regions, wells, and reservoirs, in respect to rarity and density, together with the incidental difference due to the variety of seasons and uses. So then the water of some determined region and known city is selected, and we observe upon the water-weight of the body, noting exactly what it is, relatively to the weight of one hundred mithkals; and we refer [all] operations to that [result as a standard], and keep it in mind against the time when we are called upon to perform them, if the Supreme God so wills. In winter one must operate with tepid, not very cold water, on account of the inspissation and opposition to gravity of the latter, in consequence of which the water-weight of the body [weighed in it] comes out less than it is found to be in summer. This is the reason why the water bowl settles down when the water has just the right degree of coldness, and is in slow motion, while, in case it is hot and moving quickly, or of a lower temperature, yet warmer than it should be, the bowl does not settle down as when the water is tepid. *The temperature of water is plainly indicated both in winter and summer*; let these particulars therefore be kept in mind." (Lect. V., Chap. vi., sec. 5.)

An examination of these extracts compels a belief that the Arabian philosophers of the twelfth century knew the air to have weight, though they never applied the means they had discovered of measuring it. The sentence in italics leads to the conjecture that they also had some means of determining the temperature of water; possibly a form of aërometer was the instrument employed, and they were thus enabled to recognise the fact that the density of water increases in proportion to its coldness.

Al-Khazini's work contains several tables of the specific gravities of substances determined either by the "Balance of Wisdom" or by the hydrometer of Pappus. In these tables are enumerated fifty substances, nine of which are metals, ten precious stones, thirteen materials of which models were made, and eighteen liquids.

It is interesting to learn that the Arabian physicists fully appreciated the necessity of operating on pure materials and the advantages of averaging the results of many determinations. Thus, Al-Khazini says he purified gold by melting it five times, after which it melted with difficulty, solidified rapidly, and left hardly any trace upon the touchstone; and, after ten trials to obtain the weight of the volume of water displaced by different weights of the gold, he found, for a hundred mithkals of gold, weights varying from 5 mithkals 1 danik and 1 tassuj to 5 mithkals 2 daniks; as mean weight he adopts 5 mithkals 1 danik 2 tassujs.

Likewise mercury was purified by passing it repeatedly through many folds of linen cloth. In writing of mercury he remarks that it is not, properly speaking, a metal, but it is "the mother of the metals, as sulphur is their father." This view of the nature of mercury was prevalent among Arabian chemists, and is found in the writings of Geber (or Djafar), who lived four centuries earlier. Geber writes of mercury, "It is also (as some say) the matter of metals with sulphur,"* and he does not place it in the same class with metals which he defines as "extensible under the hammer," a property not possessed by mercury under ordinary conditions.

In this conception of al-Khazini we find, moreover, the germs of the doctrine of the transmutation of metals, the basis of that alchemical pseudo-science which subsequently acquired such a wonderful influence over the human race. For if metals have mercury for a mother and sulphur for a father, they are not simple substances, and if compounds they are capable of artificial preparation and mutual transformation. This is, however, not the only passage containing allusions to a belief in transmutation, though no mention occurs of any practical attempts to effect it. The following extract clearly refers to the compound nature of metals:—

"When the common people hear from natural philosophers that gold is the most equal of bodies, and the one which has attained to perfection of maturity, at the goal of competition in respect to equilibrium, they firmly believe that it is something which has gradually come to that perfection by passing through the forms of all [other metallic] bodies, so that its gold nature was originally lead, afterwards became tin, then brass, then silver, and finally reached the perfection of gold."

Al-Khazini gives detailed accounts of the precious stones, of which we quote a few brief extracts. He says—"Emerald and chrysolite are interchangeable names, whether applied to one and the same thing, or to two things of which one has no real existence," a passage which shows that mineralogical terminology was afflicted with superfluous synonyms at an early day. Of the cornelian he says—"Men have long tired of the cornelian, so that it has ceased to be used as a stone for seal-rings; even for the hands of common people, to say nothing of the great." Of the "fine pearl" he writes—"The pearl is not a stone at all, but only the bone of an animal, and not homogeneous in its parts." "Coral," he writes, "is a plant, though petrified like the Jew's stone and the sea-crab." He is aware that "glass is not the product of a mine, but, on the contrary, kindred to stones, or sand, or alkali," and he states that he has included it in the list "because it resembles crystal."

Besides these contributions to the knowledge of specific gravities, al-Khazini devotes some attention to certain subjects not closely connected with the main theme. In the third lecture he attempts to calculate the quantity of gold which would compose a sphere equal to the globe of the earth, and arrives at a number of mithkals which requires for expression 29 digits.

In the same lecture he takes up the problem of the chess-board, of which he supposes the squares to be filled with dirhams, each square containing twice the number in the preceding: he finds the total number of dirhams to be 18,446,744,073,709,551,615. He then applies himself to ascertaining the dimensions of the treasury in which the treasure should be deposited, and finally quotes the lines of an Arabian poet which fix the time in which one might spend this sum at 200,000,000,000,000,000 years.

In the last lecture he describes the methods of applying the balance to levelling and to the measuring of time. Of this portion M. Khanikoff gives the following concise exposition:—

"The balance level consists of a long lever, to the two ends of which were attached two fine silken cords, turning on an axis fixed at a point a little above its centre of gravity, and suspended between two sight-pieces of wood, graduated. At the moment when the lever became horizontal the cords were drawn in a horizontal direction, without deranging its equilibrium, and the divisions of the scales of the sight-pieces corresponding to the points where the cords touched them were noted. For levelling plane surfaces use was made of a pyramid with an equilateral triangular base, and hollow and open to the light

* Geber, "Sum of Perfection," Book I., part iii., chap. 6.

from the summit of which hung a thread ending with a heavy point. The base of the pyramid thus arranged was applied to the plane which was to be levelled, and carried over this plane in all directions. Wherever the plane ceased to be horizontal the joint deviated from the centre of the base.

"The balance-clock consisted of a long lever suspended similarly to the balance-level. To one of its arms was attached a reservoir of water, which, by means of a small hole perforated on the bottom of it, emptied itself in twenty-four hours. This reservoir, being filled with water, was poised by weights attached to the other arm of the lever, and in proportion as the water flowed from it the arm bearing it was lifted, the weights on the other arm slid down, and by their distance from the centre of suspension indicated the time which had elapsed."

Many points of interest, demanding at least a passing notice, may be embodied in a summary of the principal propositions contained in this treatise:—

1. The "Book of the Balance of Wisdom shows the Arabian philosophers of the twelfth century to have entertained advanced views regarding attraction. They recognised gravity as a force, and attributed to it a direction towards the centre of the earth; they also knew that it diminishes with the distance, but they erroneously supposed this diminution to be in the direct ratio of the distance, and not as its square.
2. They were acquainted with the connection between the weight of the atmosphere and its increasing density, since mention is made of the loss of weight of a body weighed in a denser atmosphere.
3. They understood the theory of centre of gravity, and applied it to the investigation and construction of balance and steelyards.
4. They made frequent use of the hydrometer, which they inherited from antiquity, and possibly they employed this instrument as a thermometer for distinguishing by variations of density the different temperatures of liquids.
5. They observed the action of capillary attraction.
6. They compiled full and accurate tables of the specific gravities of most of the solids and liquids with which they were acquainted.
7. Their system of philosophy was founded on experiment and observation.

In conclusion we quote the following appropriate remarks from M. Khanikoff's introduction:—

"The history of the sciences presents to us an incontestable fact of deep significance—the re-discovery in modern times of truths laboriously established of old; and this fact is of itself enough to indicate the necessity of searching carefully in the scientific heritage of the past after all that it may be able to furnish us for the increase of our actual knowledge; for a double discovery, necessarily requiring a double effort of human intellect, is an evident waste of that creative force which causes the advance of humanity in the glorious path of civilisation."

CORRESPONDENCE.

ORGANISATION AMONG CHEMISTS.

To the Editor of the Chemical News.

SIR,—My letter to you of the 6th June last, published in the CHEMICAL NEWS (vol. xxxiii., p. 240), has led to some persons, interested in the establishment of the proposed Institute, addressing communications to me, in some cases seeking for information as to the details of the scheme and promising both moral and financial support, and in other cases making suggestions with a view to my clients' scheme being made more perfect in its details.

In all cases I find a strong feeling prevailing amongst chemists of character and position as to the necessity for vigorous steps being taken to raise the status of persons adopting chemistry as a profession: and now that what has for a long time past seemed to be idle talk, or the dreams of visionaries, is assuming a form, and showing the elements of vitality, a lively interest is displayed by many who are desirous that as soon as practicable the Institute should be established and its important work commenced.

Questions are, however, from time to time raised as to the persons to be admitted to membership, and the manner of their election. Your readers may rest assured that these questions have already received full consideration on the part of the active promoters of the scheme.

The qualifications of the several classes of persons, and the conditions upon which they were to be received into the membership, as stated in my letter to you (CHEMICAL NEWS, vol. xxxiii., p. 240), were not agreed to before objections thereto had been anticipated, and in consultation between some of my clients and myself fully discussed. It was felt that under all circumstances the regulations upon this point recommended by my clients would in actual working prove to be conducive to the success of the Institute, and as valuable in promoting its objects as any that could be devised. It was not, however, expected that all chemists would at once accept this part of my clients' scheme, but although alterations therein have been suggested to me I still consider that my clients' proposals are the best, and when fully understood will prove the most acceptable.

It is objected that inasmuch as all persons who have "practised on their own account in the profession of a consulting or analytical chemist for a period of five years" are to be eligible for election without producing evidence of training and fitness or undergoing an examination to prove such fitness, that "high" and "low" analysts and quacks will not be excluded from membership, and that the principal object of the Institute will thus be lost. To guard as far as practicable against the admission of incompetent or disreputable men it is intended that every person proposed for election should be nominated by five persons having personal aquaintance with the candidate, that his name and the names of his nominators (after being submitted to the Council), and the date of his election should be communicated by post to each member of the Institute fourteen days before the date of election, and that at the ballot four-fifths of the members present must vote in the candidate's favour to secure his election. If the members do their duty, and act in a spirit of high honour in the observance of these regulations it is thought that improper persons will be kept out of the Institute but should any such person become a member, the power of expelling therefrom, upon proof of unworthy conduct, will, if the members are true to the principles governing the Institute, be sufficient to ensure that all persons wearing the dignity of membership shall be honourable and trustworthy men.

It has been suggested that "works'" chemists should be entitled to become candidates for election on the same conditions as persons "who have practised as chemists on their own account for at least five years," and consequently without affording the evidence of training and employment as proposed in my letter of the 6th of June last, under the heading, "As to persons not now employed as chemists." Works' chemists are in many cases highly trained, able, and conscientious men, and in such cases difficulty will not be experienced in their establishing their qualifications and fitness for admission into the Institute. But it is, I believe, an acknowledged fact that many "works'" chemists are ill trained, and, except as to their own particular branch of chemical manufacture, are, in many cases, ignorant of the simplest principles of chemistry as a science, and beyond the circle of their own employment are quite unknown, and certainly have no public (and, outside the scene of

heir employment, any scientific) reputation. The Institute would undoubtedly suffer if all "works'" chemists were indiscriminately admitted to membership without producing evidence of training and subsequent employment. As in the varied walks in life the innocent are required to suffer for the guilty, so in the case of the Institute, the competent "works'" chemist will have to prove his distinction from the incompetent servant, but having done this the honour of membership will be more clearly brought out, and be more thoroughly appreciated.

It is obvious that in practice it would be found impossible for the Council of the Institute to enforce any rule requiring candidates "now practising as chemists on their own account" to bring evidence of their training and fitness, and the Council could not make selections amongst that class of persons, requiring some to bring such evidence and permitting others to come without it. They would place themselves in a most invidious position were they to attempt to do so.

As it is understood the Chemical Society is now advised that it cannot alter, or add to, its name, or sanction the creation of an Institute which shall be an adjunct to the Society, and in fact form a part thereof, it is desirable that the question of the establishment and the government of the Institute should now be taken earnestly in hand, so that an unnecessary delay may not occur after the recess in making the organisation complete.

I shall receive with much pleasure any suggestions from your readers upon this important and interesting subject.—I am, &c.,

J. Pettengill.

32, Walbrook, London, E.C.
August 3, 1876.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances, de l'Academie des Sciences. No. 2, July 10, 1876.

Note on a Communication by M. Sacc, entitled "On Panification in the United States, and on the Hop as a Ferment."—M. L. Pasteur.—The author maintains, in opposition to M. Sacc, that the hop does not contain a soluble alcoholic ferment.

Objections to the Last Communication of M. Hirn on the Maximum Possible Repulsive Pressure of the Solar Rays.—M. A. Ledieu.—The author, like M. Hirn, admits the excellence of the application of the method of successive elimination to the study of the cause of motion in the radiometer of Mr. Crookes; but an erroneous employment of this method only introduces a new element of complication into a question so delicate in itself. The numbers 0·0004157 grm. and 0·0008314 grm., proposed by M. Hirn to represent the maximum possible repulsion of light per square metre, whether for a blackened surface or for one perfectly polished, have no acceptable signification. M. Hirn assumes that the speed of the impact of the molecules striking the discs is no other than the speed of light itself, whilst in the hypothetical collision in question we must evidently consider the vibratory speed of the said molecules. But this latter velocity has *nothing in common* with the rapidity of propagation of the light-waves.

Experimental Researches on Magnetic Rotatory Polarisation (Third Part: Dispersion of the Planes of Polarisation of the Luminous Rays of Different Lengths of Waves).—M. H. Becquerel.—Unsuitable for abstraction.

Cellulosic Fermentation of Cane-Sugar.—M. E. Durin.—Cane sugar is split up into equivalent weights of cellulose and levulose under the influence of a special ferment. The ferment which determines this transformation is of a diastasic nature.

Difference of the Potential Presented, after Rupture of the Inductor Current, by the Isolated Extremities of an Open Induction Coil.—A mathematical paper, not suitable for abstraction.

Reactions of Chlorine under the Influence of Porous Carbon.—M. Melsens.—With reference to the paper of M. Damoiseau, read at the last meeting of the Academy, the author urges that the influence of porous carbon upon gases is already well known to physicists and chemists.

A New Butylic Glycol.—M. Milan-Nevole.—The author describes in this paper the products obtained by the oxidation of his glycol.

Explanation of the Impressionability of the Blackened Discs of the Radiometer by the Aid of the Emission Theory, according to J. B. Biot.—M. W. de Fonvielle.—J. B. Biot, in the third volume of his "Traité de Physique," explains how the luminous molecules cannot communicate their *vis viva* to reflecting surfaces. In fact, these latter exert a truly repulsive action upon those molecules which, not touching them, cannot produce upon them any percussion similar to that impressed by electric forces. The considerations developed by this illustrious physicist not being applicable to blackened discs, we understand that the rotation of the radiometer should be produced in such a direction that they may fly from the ray. Is it not curious to find that the emission theory has permitted us to some extent, as far back as 1816, to foresee the experiment of Mr. Crookes? The explanation of the phenomenon, if we admit M. Biot's starting-point, does not require any new reasoning. The effort lost in the change of direction of the luminous molecules seems at first sight not to produce any effect, a result which does not appear reconcilable with the law of the conservation of the quantity of movement. Nevertheless, we may reply to this objection that according to the theory of emission this quantity of motion is represented by an internal ray performed upon the ray of light; for the direction of the axis of the luminous molecules has been changed since the reflection, for in place of being situated in the direction of the ray these axes have become perpendicular to that direction after the reflection. In this hypothesis the energy destroyed is represented by that which has been employed for the polarisation of the incident ray. The author has studied, along with M. Ruhmkorff, an apparatus known in Germany under the name of *light mill*—an appellation which seems to him scarcely justifiable, for the rotation of a wheel placed in the centre of a Geissler's tube seems exclusively produced by a dynamic effect peculiar to electricity, and in which light does not intervene in any manner. In fact, the vacuum is so imperfect that a radiometer placed in Geissler's tube cannot turn without the action of a ray of light. Further, the state of the surfaces has no influence upon the direction of rotation in Geissler's "mill," which is entirely bright, whilst the direction of this rotation is changed at will by altering the direction of the current. The preponderance of the negative flame, much more direct than the positive, cannot exert, as the author at first believed, any influence on this inversion, for a very sensitive radiometer, capable of being set in motion by the light from a smouldering match just blown out, was not moved by the light of an induction spark striking sufficiently near to the glass case to perforate it.

Crystallisation of Sugar.—M. G. Fleurens.—The value of this paper lies in tables which cannot be abridged.

Remarkable Case of the Reduction of Nitric Acid and the Oxidation of Acetic Acid with the Production of Alcohol under the Influence of certain Microzymas.—M. J. Béchamp.—The author controverts the view of M. Méhay that the decompositions in question are exclusively due to chemical reactions.

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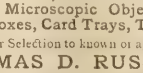

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THE CHEMICAL NEWS.

Vol. XXXIV. No. 873.

VOLUMETRIC ESTIMATION OF IRON.

By EDWARD HART.

By far the best method of estimating iron volumetrically is that by permanganate of potash, after previous reduction of the ferric to a ferrous compound. The difficulty encountered is how to perform this reduction in the best, quickest, and cheapest manner. The best and most complete method of reduction, according to my experience, is that by hydrogen, in a porcelain tube, at a red-heat. To make the reduction complete it is necessary to pass the gas over the heated ore for three hours. Not more than 0·3000 grm. of the ore should be taken, otherwise at the end of the time specified the reduction will be found to be incomplete. The ore is weighed out in platinum boats, four of which may be placed in the tube and reduced at once. The tube is allowed to cool while the hydrogen is still passing the boats, removed, and carefully dropped into flasks containing hot dilute sulphuric acid. The flasks are closed with doubly-perforated corks, and a current of hydrogen is passed into them while the iron is dissolving. When the solution is complete the flasks are plunged into cold water (hydrogen being still passed into them) and allowed to cool completely, and are then titrated in the usual way. Coal-gas cannot be used in place of the hydrogen, as some of its constituents dissolve in the hot acid and exercise a reducing action on the permanganate. With a great many ores, especially limonites, the reduced iron dissolves with great difficulty, sometimes not at all. This difficulty has been overcome by Dr. T. N. Drown, who passes oxygen or air over the heated ore for half an hour before reducing. The carbonaceous matter is in this way destroyed, and the reduced iron is found to dissolve with the greatest ease. In this modified form I know of no more elegant and accurate method of determining iron in its ores. Some results obtained at different times, on different ores, show the precision of the method. The numbers represent percentages of metallic iron.

No. 1.		No. 2.		No. 3.	
62·19	Average, 62·195.	66·69	Average, 66·63.	47·97	Average, 47·98.
62·25		66·64		47·86	
62·11		66·64		48·01	
62·22		66·55		48·09	

No. 4.		No. 5.	
48·88	Average, 48·71.	52·00	Average, 52·01.
48·50		51·99	
48·67		52·04	
48·78			

Almost all the magnetites when dissolved in acid leave a residue containing iron. The iron in this residue is not reduced by the hydrogen when the iron is determined as above. In this respect, however, the process is neither better nor worse than those ordinarily used. There are only two valid objections against this method. The first is the gas consumed, which makes it costly. The second the time required—from four to six hours. In order to find a means of determining iron very rapidly, with a reasonable degree of accuracy, various processes have been tried, but thus far none have given better results than that by reduction of the hydrochloric solution of the ore by stannous chloride. The ore was dissolved in hydrochloric acid in a beaker, and evaporated nearly to dryness. The solution was then diluted with a little water, and an excess of stannous chloride run in from a burette. After the fluid had lost colour a little starch solution was added, and iodine solution run in from another burette until the blue iodide of starch remained permanent. It was found best to have the iron solution rather concentrated and warm. One c.c. of the stannous chloride solution was equivalent to about 0·0120 metallic iron and 3 c.c. of iodine solution. The stannous chloride worked best when freshly prepared. Ten determinations of iron in a limonite gave—

38·18	38·39	38·31
38·07	38·15	38·13
38·25	38·25	38·17
38·45		

Average, 38·235.

Two determinations of the iron in the same sample, by the preceding method of reduction by hydrogen, gave—

38·00 and 38·16.

A gravimetric determination by Dr. Drown, in another sample of the same ore, gave—

38·14.

These results for technical purposes are as good as is necessary. Four of the samples were weighed, dissolved, reduced, and titrated in an hour and twenty minutes. In a second trial, with four more samples, the same time was taken. In both cases the solutions were standardised while the ore was dissolving. This gives an average of twenty minutes as required for one determination, which is all that could be desired. I find it best to standardise the stannous chloride solution by means of metallic iron. This is dissolved in hydrochloric acid and a few pieces of potassium chlorate added; after which the solution is evaporated nearly to dryness. By this means every trace of free chlorine seems to be expelled. A solution of ferric chloride, when freshly prepared, is reduced almost immediately upon addition of the stannous chloride. After standing some time, however, it is more slowly reduced, and seems to require less tin solution. A solution of ferric chloride which had been kept for some months, one volume of which by precipitation in a platinum dish by ammonium hydrate gave 0·1024 and 0·1024 iron, when estimated by means of the tin solution gave—

0·1017	0·1010
0·1012	0·1007

results which are neither high enough nor closely agreeing.

Lafayette College, June, 1876.

NEW FORM OF COMPENSATING PENDULUM.

By J. LAWRENCE SMITH, Louisville, Ky

In the construction of this new form of compensating pendulum I have taken advantage of the very great expansibility of that combination of sulphur and caoutchouc known as vulcanite or ebonite. Its coefficient of expansion is known to approach that of mercury in the ranges of temperature from 0° to 70° C.

The mechanical arrangement adopted is a very simple one. The rod of the pendulum is of round steel, with an adjusting screw at the lower end; a round rod of vulcanite with a hole in the centre is passed on to the steel rod, fitting it loosely, and being held in place by the adjusting screw. The bob of the pendulum consists of a heavy mass of brass, with a hole through the centre large enough to admit the vulcanite over which it passes, and, by a properly arranged stop, rests on the end of the vulcanite farthest from the lower end of the pendulum, so that any expansion of the vulcanite elevates the brass bob, thus compensating for the downward expansion of the steel rod and brass bob.

There is a simple mechanical arrangement for adjusting the proper difference between the length of the vulcanite and the other parts of the pendulum.

For a second pendulum to an astronomical clock I have used the following dimensions:—Diameter of the steel rod, 6 m.m.; diameter of vulcanite, 25 m.m.; length of same, 165 m.m.; diameter of brass bob, 63 m.m.; length of the same, 156 m.m. These dimensions are in no way insisted on as being the best. For a half-second pendulum I have used a steel rod, 3 m.m. in diameter; vulcanite, 11 m.m. in diameter and 63 m.m. long; brass bob, 38 m.m. in diameter and 57 m.m. long.

I have had one of these pendulums attached to an astronomical clock, and after adjustment it has been running four months with very satisfactory results. Should this form of pendulum prove itself constant and correct, it would certainly be a convenient one for transportation, and very much less costly than the ordinary form. And as for the half-second pendulum, in such constant use in mantle clocks, it will be of the greatest service, and not add more than 20 cents cost to the commonest form of pendulum that can be used.

As regards the uniformity of the coefficient of expansion of all vulcanites, of course it is not to be supposed that it can be relied upon; but a very simple method is used to ascertain it for any single specimen, or for a number made of the same lot of material.

I have made experiments on several different specimens, and the results vary little from each other. The range of temperature with which the experiments were made was from zero to 43° C., on a bar 25 m.m. in diameter, and 304 m.m. long, this expanding in length 9 to 10 m.m.; making the entire expansion equal to 1-126th of the entire length of the rod for a temperature ranging from freezing-to boiling-point, giving as coefficient for linear expansion for 1° C. 0·000079365. This coefficient is seen to be lower that that of mercury: but from the fact that mercury corrects the pendulum by only one-half its expansion, and the vulcanite is made to correct it by its entire expansion, the length of vulcanite required is even less than the column of mercury used in the mercurial pendulum. This instrument is one whose use depends on its accuracy of operation after careful trial for some time.—*American Journal of Science and Arts.*

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 52.)

Chlorine, Bromine, Iodine, and Fluorine.
By Dr. E. Mylius, of Ludwigshafen.

Deacon observed that the decomposition between hydrochloric acid and oxygen takes place at a far lower temperature if the gaseous mixture, instead of passing simply through ignited tubes or over porous substances, is conducted over heated salts of copper, lead (except the sulphate), or compounds of manganese. The copper salts were found most effectual, so that when a mixture of hydrochloric acid with an excess of atmospheric air was passed over porous bodies saturated with sulphate of copper and heated to 370° to 400°, all the hydrochloric acid was burnt to chlorine and water. In this reaction, which begins at 260°, the sulphate of copper remains unchanged if the temperature is not raised too high. Not till 425° does the formation and volatilisation of chloride of copper begin. The permanence and the efficacy of the sulphate of copper can be increased by the presence of certain salts inactive in themselves, such as the sulphates of potash and soda.

A number of experiments conducted by Deacon in concert with Hurter and Carey, since the year 1867, have led to a knowledge of the conditions of the reaction of air and hydrochloric acid in presence of salts of copper.*

1. The quantity of the hydrochloric acid decomposed by a molecule of copper sulphate in gaseous mixtures of similar composition at the same temperature depends on how often the gaseous molecules pass through the sphere of action of the copper salt.

2. At all speeds of the gaseous current in long tubes of the same section, the opportunity for action in one and the same time is invariable.

3. In long tubes of different sections the opportunity of action is equal when the velocities of the currents are inversely as the squares of the diameters of the tubes.

4. In porous masses the efficacy increases directly as the speed.

5. Other conditions being equal the quantity of hydrochloric acid decomposed varies as the square root of the number expressing the proportion of the hydrochloric acid and oxygen.

6. At very high temperatures a certain quantity of chloride of copper is formed, but its amount stands in no proportion to the chlorine liberated.

7. The efficacy of the copper salt extends to gas molecules not in contact with the salts; the decomposition of the hydrochloric acid takes place, therefore, under conditions in which a material exchange between the copper salt on the one hand and the hydrochloric acid and air on the other cannot take place.

Without entering upon the experiments made to explain the efficacy of the copper salt we turn to the method of the practical execution of Deacon's process as hitherto carried out.

The hydrochloric acid is either prepared from salt and sulphuric acid in a common salt-cake furnace or from previously prepared aqueous hydrochloric acid. On a small scale the latter is preferable, as in this manner it is easy to produce a current of hydrochloric acid of always equal strength, whilst the evolution of hydrochloric acid in the preparation of salt cake is very rapid at first, and subsequently becomes slow. On the large scale this difficulty is met by allowing several salt-cake furnaces to work in a series, so that when the evolution slackens in one, the activity of the next commences. The gas obtained in one or other manner is at once mixed with a quantity of air containing more oxygen than suffices to convert all the hydrochloric acid into chlorine. It is then conducted through heated U-tubes of cast-iron, which communicate to it the temperature required for the process. The composition of the gaseous mixture can be regulated at any moment by a small air-pump which, at every piston stroke, drives a certain volume of gas through a standard solution of soda coloured with litmus.

From the heated tubes the gaseous mixture passes downwards into an almost cubical tower whose interior is filled with wall-stones arranged like a grating, and whose sides are traversed by flues, which keep up the temperature favourable for the process. The heat here, as in all other parts of the apparatus, is regulated by metallic pyrometers. The tower fitted up with stone blocks (the Regulator) serves to take up the excess of heat from the gaseous mixture, if the temperature has been carried too high, or to impart heat to it if the proper degree has not been reached. Recently, however, Deacon considers the regulator as unnecessary.

(To be continued)

* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzenends."

* Henry Deacon. "On Deacon's Method of Obtaining Chlorine Illustrating some Principles of Chemical Dynamics." *Chem. Soc. Journ.*, 1872, 725.

PLATINUM COMBUSTION TUBES.

In Liebig's system of organic analysis glass combustion tubes are employed, to the exclusion of either metallic or porcelain retorts. But the chemists who first performed ultimate organic analysis occasionally used metallic combustion tubes, and Henry, in his work on chemistry, published in 1826, states:—"The tube for containing the mixture of the oxide and the body to be analysed is by some preferred of copper, by others of crown or green bottle-glass; but glass tubes seem, on the whole, to be preferable to metallic ones."

Although glass combustion tubes have been successfully used for a number of years, yet it is questionable whether glass is really the best material from which to construct apparatus intended to bear exposure to high temperatures.

A glass tube, as a rule, can only be used once, and when several analyses have to be performed "charging" the combustion tube becomes an extremely irksome duty. For filling the combustion tube is an operation which requires strict attention to minutiæ, a slight deviation from some rule being sufficient to vitiate the results. And even when a tube has been carefully filled there is always a chance that it may either crack or "blow out" during ignition.

If an analysis could be performed in a few minutes an unsatisfactory result would be of trifling moment; but when the time spent over an analysis is remembered, a defective combustion means the loss of some hours' labour.

Platinum is apparently well suited for the construction of combustion tubes, and if tubes of that metal could be employed it is probable that the time spent over mechanical details in organic analysis would be considerably lessened. A platinum tube about 18 inches in length, and open at both ends, would be of convenient size for a combustion tube. Its internal diameter might be rather narrower than that of a glass tube, while its sides need not be thicker than that of an ordinary crucible. One end of the tube ought to be provided with a platinum cap, which should either slide or screw on, so that the junction between the two may be gas-tight at a red heat.

Given, then, a tube as above described: the question arises—How is it to be filled with cupric oxide? The following is a simple plan:—

(1.) The inner surface of the tube is to be coated with copper. This is done by filling the tube with a solution of cupric sulphate, and then decomposing the salt by means of voltaic electricity.

(2.) The tube having been well washed and dried, a cylinder of tightly-rolled fine copper gauze, about 9 inches long, and rather smaller than the internal diameter of the tube, is introduced, and pushed on until within 6 inches of that end of the tube which is provided with a cap.

(3.) The tube with its contained cylinder of copper gauze is now heated to redness in a combustion furnace, and a stream of oxygen passed through it so as to oxidise the copper.

The substance to be analysed should be mixed with cupric oxide, and placed in a platinum "boat" about 5 inches in length; one end of the "boat" ought to be filled with dry potassic chlorate. The "cap" having been fitted on, and the potash and sulphuric acid bulbs attached, the whole of that portion of the tube which contains the 9 inches of cupric oxide can be heated to redness, and the analysis conducted in the usual manner.

By using small tubes, which could readily be weighed, it would be possible to determine the loss of oxygen experienced by the cupric oxide during a combustion. Suppose it is necessary to examine a body containing CHO. Arrangements would have to be made so as to allow a stream of nitrogen to pass through the apparatus.

The substance to be analysed is to be mixed with cupric oxide, and placed in the "boat." The bulbs, &c., are then attached, and a stream of nitrogen passed through the apparatus so as to displace the air, and the analysis conducted in the usual way.

If the combined weight of the combustion tube and boat, with their contained oxide of copper, is known before ignition, then the loss after combustion will represent the amount of oxygen abstracted from the cupric oxide, and if the substance analysed contained no oxygen, then the amount of oxygen found in the potash and sulphuric acid bulbs will be equal in weight to the oxygen lost from the oxide of copper. But should the body contain oxygen then the difference between the amount of O lost by the cupric oxide and that found combined with the H and C will represent the amount of O present in the substance analysed.

With a platinum tube filled with cupric oxide in the manner above described it would be possible to perform a succession of analyses, thus greatly economising time. This arrangement of apparatus is based on purely theoretical considerations. I have had no opportunities of practically testing the value of platinum combustion tubes.

C. J. H. W.

Bhagulpore, Bengal.

PHOSPHINE (PH_3).

The only method of obtaining absolutely pure phosphine is by the decomposition of phosphonium iodide by water, which yields PH_3 and HI, but very pure phosphine may be obtained by the action of sodic ethylate on P in alcoholic solution. The evolution of gas commences on warming slightly, and will continue regular for some days. From a strong alcohol solution the excess of hydrogen rarely amounts to more than $1\frac{1}{2}$ per cent.

Aqueous and alcoholic solutions of ammonia (nitrine) produce, when digested with phosphorus, mere traces of phosphine, only either at the ordinary temperature or the boiling-point.

Clear phosphorus immersed in strong alcoholic ammonia and exposed to light (direct sunlight when that could be obtained) for a period of nearly six months, yielded only a very small amount of gas containing a trace of phosphine merely, a white crystalline deposit forming on the sides of the glass vessel in very small quantity. (It appears to be only white phosphorus.) Similar formation of crystals was noticed by Commaile.

A smaller amount of similar looking white crystals mixed with red phosphorus formed on the sides of a flask containing aqueous ammonia to which phosphorus had been added.

Glycerin does not prevent the formation of the spontaneously inflammable gas when added to the aqueous potash solution used for generating it; even strong glycerin with only 1 to 2 per cent water when treated with potash and phosphorus gives off the spontaneously igniting gas at the ordinary temperature slowly.

W. R. H.

Royal College of Chemistry.

CYANOGEN.

Cyanogen, in solution in alcohol or water, rapidly undergoes decomposition, para-cyanogen, ozulmic acid, and ammoniacal products being formed.

With absolute alcohol saturated with dry gaseous cyanogen in the dark, a colouration due to decomposition was observed to commence after about an hour's exposure to sunlight (in February and March); the same solution maintained in darkness required four hours to develop the same depth of colour. The rate of decomposition is about the same when ether is used.

But when dry chloroform, carbon tetrachloride, crystallisable glycerin, carbonic sulphide, or benzol are used no colouration or decomposition was found to take place, even after exposure to sunlight for three months. In the case of the solutions which do undergo decomposition, such as alcohol, all the cyanogen is not removed or decomposed in the space of three months. A solution in absolute alcohol made in March (1876) still yielded a cyanogen distillate in June.

W. R. H.

Royal College of Chemistry.

PLASTIC SULPHUR.

It may perhaps be interesting to know that plastic sulphur may be formed at the ordinary temperature. When sulphuretted hydrogen is passed into water containing iodide in suspension, hydric iodide is formed and retained in solution, and a mass of sulphur is formed which may be drawn out into threads, and behaves in all respects like the plastic sulphur formed in the usual way by heat.

The whole of the sulphur is not in the plastic state, there being some ordinary precipitated sulphur intermixed.

The colour is light red, due to iodine or probably a sulphur iodide.

W. R. H.

Royal College of Chemistry.

NOTICES OF BOOKS.

On the Presence of Arsenic in the Vapours of Bone Manure; a Contribution to Sanitary Science. By James Adams, M.D.

It appears that early in the present year a gentleman in the north of Scotland, whilst passing into a railway station, "encountered a volume of offensively smelling vapour that was suddenly disengaged from a bone manure works, which (somewhat singularly, in our opinion) practically forms part of the station." He immediately, as we are told, became sick and faint, and "continued vomiting until he reached Inverness," where, in spite of the best medical advice there to be procured, he died on the fourth day after encountering the evil odour. His previous health is represented as having been excellent. On this fact, which, we should say, indicated some peculiar idiosyncrasy or very abnormal susceptibility on the part of the deceased gentleman, Dr. Adams founds a serious charge against chemical manure works in general.

The nuisances which they occasion are, according to our author, of a complex nature. There are, first, the gaseous exhalations from decomposing animal matter, which, we are told, "may not only cause a nuisance but they may kill." Of these gases carbonic acid and sulphide of ammonium are given as examples. We believe it is rather uncommon for these two compounds to be thrown off from a manure works in such an amount as to affect the health of the vicinity.

There are next miasms, morbid poisons, or organic poisons, the causes of fever, cholera, &c. These are by many authorities considered as solid organised bodies, merely held in suspension in the air. Dr. Adams, however, pronounces them "another class of gaseous exhalations proceeding from decomposing animal matter." However this may be he ventures to consider a manure works as dangerous, on this score, as a crowded churchyard. To this view we must take decided exception. The amount of putrescible matter received in ordinary manure works is very small. A large part of the bones worked up arrive as bone-ash and as spent bone-black; a further portion consists of boiled bones, and even of the green bones a large quantity is generally dry and very unlikely to undergo decomposition. How stores of such materials can produce effects at all comparable to those of a crowded church-yard, where the bulk of the matter deposited is of a putrescent nature, Dr. Adams might find it difficult to show.

But there is yet a third class of emanations—volatile compounds of arsenic and antimony. The sulphuric acid employed contains arsenic, generally in the state of arsenious acid. This arsenious acid, in the process of dissolving bones, coprolites, apatite, &c., is decomposed by the chlorides, fluorides, &c., present, and there is, in consequence, an evolution of such delightful compounds as arseniuretted hydrogen, chloride and fluoride of arsenic, &c.

Now the presence of arsenic in pyrites, and consequently in sulphuric acid, is not to be disputed. Nor can the reaction by which it is said to be volatilised be pronounced impossible. But that it is given off to the extent here assumed may well be questioned. If arsenic is as widely diffused and as generally present as Dr. Adams holds the greater is the probability that it may have been present not in the suspected material but in some of the reagents employed. We should like to know whether, in all the investigations described or referred to in this pamphlet, a so-called "blank experiment" was first made to eliminate this source of error.

But there is yet a further question:—To what extent can chlorides and fluorides of arsenic and antimony be mixed with moist air, and to what distance can they be conveyed without undergoing decomposition? We should recommend Dr. Adams to take a station 600 yards from a manure works—the distance of Bunchrew House from the inculpated factory—to draw a few thousand litres of air through water and to examine the resultant solution for arsenic.

Let us now examine the three sources of death and disease alleged to be given off from manure works, as here laid down. Miasms or organic poisons could scarcely meet with a more efficient corrective than chloride of arsenic, fluorine, and other of the volatile compounds said to be given off. On the other hand sulphuretted hydrogen and sulphide of ammonium are admirably calculated to purge the atmosphere of arsenical fumes.

We have had abundant occasion to examine chemical manure works, and have observed not merely the proprietors, officials, and workmen, but the population of the respective neighbourhoods. But there were neither mysterious and inexplicable deaths, nor a generally lowered tone of vitality. The only complaints we have ever heard had reference to the injury to vegetation from the fumes escaping from the chambers. We consider ourself fully justified in declaring that if manure works were the sole or the most formidable sanitary nuisance in existence we should have reached the condition of Dr. Richardson's model city. We should recommend manure makers to take every practical precaution (as indeed most of them already do), but we must protest against their being singled out for special condemnation on the score of a single case. If we load chemical manufacturers with conditions which render it impossible for them to work at a profit the result is not difficult to foresee.

Tables forming an Appendix to W. Dittmar's "Manual of Qualitative Chemical Analysis." Edinburgh: Edmonston and Douglas.

We have some time ago had an opportunity of expressing our opinion of Mr. Dittmar's valuable manual. The collection of tables, issued as an appendix, embrace "Metals, their mechanical and physical properties, and behaviour in *the* heat (an un-English expression); behaviour of metals with aqueous reagents; properties of the more important metallic oxides; metallic oxide and

dry-way reagents; generic reactions of mineral acid solutions of groups of metallic oxides; data for the discrimination of the oxides of the silver and copper groups; data for the discrimination of the oxides of the arsenic, iron, barium, and magnesia groups; general scheme for the analysis of a complex of metallic oxides dissolved in aqueous mineral acid or alkali; examination of filtrate from sulphuretted hydrogen precipitate; conspectus of methods for detection of non-metallic elements; action of salts on general acid detectors; and general scheme for the analysis of solids. The tables are printed on good paper and the characteristic reactions are brought prominently before the reader.

Annual Record of Science and Industry for 1875. Edited by SPENCER F. BAIRD. London: Trübner and Co.

THIS useful record has now reached its fifth annual volume, and in our opinion maintains its satisfactory character. In addition to a classified selection of extracts from scientific journals and the Transactions of learned societies, there is a general summary of scientific and industrial progress during the year 1875, an obituary of eminent scientific men, and a bibliography, which, however, does not profess to be exhaustive.

We believe that few discoveries, inventions, or other scientific facts of importance, will be found to have been omitted, and, as there is in every case a reference to the original authority, the work will be invaluable to all who wish to know the general results obtained during the past year. Much that is novel cannot be expected, since a considerable time must elapse after the expiration of the year before such an extensive assortment of facts can be compiled.

The classification of subjects is—Mathematics and astronomy, terrestrial physics and meteorology, general physics, chemistry and metallurgy, mineralogy and geology, geography, general natural history and zoology, botany, agriculture and rural economy, domestic and household economy, mechanics and engineering, technology, materia medica, and miscellaneous. This classification might doubtless be amended in several respects, but methodological accuracy is not in request in England, where the majority of the "respectable and intelligent classes" cannot even discriminate between "science" and "art," and apply the former term to very strange pursuits.

Causeries Scientifiques. Par HENRI DE PARVILLE. Paris J. Rothschild.

THIS work has now reached the fifth year of its useful career. The present issue, like its predecessors, gives a brief, chatty, and readable account of recent discoveries, inventions, and other topics of scientific interest.

The first paper, on the invasions of the sea, contains, among other things, a hypothetical map of the ancient isle of Atlantis,—not in accordance with the modern Dutch theory,—and a somewhat better established chart of the coast of France in the times when Jersey and Alderney were still part and parcel of the mainland. It is a somewhat unpleasant fact that the lands submerged within the last few thousand years seem generally to have had mild climates, whilst the territories recently elevated —such as certain parts of Siberia—are not merely cold and dreary in themselves, but are the lair whence the late Canon Kingsley's favourite wind issues to desolate Western Europe.

The next chapter contains an account of the "patent colours" of Croissant and Bretonnière, and of the tempered glass of M. de la Bastie, though the rival process of M. Siemens, of Dresden, seems to have been overlooked.

A notice of the recent discoveries on the carnivorous habits of certain plants is introduced, with the somewhat strange remark that since the researches of Darwin "no one will accuse *savants* of being devoid of imagination!" Further on we are told—"Let the Darwinists continue their interesting romance." From some occult reason the countrymen of Lamarck look coldly upon modern Evolutionism, and have contributed very little to the recent progress of the organic sciences.

The account of the experiments of Prof. Heckel, of Montpellier, on the action of substances which hasten the germination of seeds, ends with a curious,, and as some of our readers will think, an impertinent reflection:—"Who knows? pharmacy, which does so much evil to man, may, by way of compensation, do some good to vegetables."

There is an interesting notice of the effects of the rarefied air of high mountains upon the human life. The monks of St. Bernard rarely exceed the age of 35, and the majority of them die between 25 and 30. At the Little St. Bernard, according to Dr. Niepce, none of the inhabitants attain the age of 45. The author nevertheless thinks that moderate elevations, say from 800 to 1500 metres, are favourable to health and vigour. Here, although the amount of oxygen inhaled is smaller, yet, according to Jourdanet, the carbonic acid is eliminated more readily from the blood, and the vital energy may be consequently greater.

It is mentioned as a curious fact that ashes from the great fire of Chicago fell in the Azores on the fourth day from the commencement of the conflagration, whilst the empyreumatic odour led the inhabitants to suspect that some great forest was burning on the American continent.

According to the investigations of Dr. Viand Grand Marais the bite of the common viper is much more dangerous than is commonly supposed. Out of 362 cases which he has recorded, 63, or rather more than one-sixth, have proved fatal, one of the deaths occurring in two hours after the bite. It is remarked that in all these cases "ammonia had been largely employed," though we do not learn in what manner. The question is somewhat complicated by the fact that there are two species of venomous serpents in France, as indeed in all the more southern parts of Europe,—the true viper, "*pelide*" (*Pelias Berus*), found also in England, and the asp "*aspic*" (*Vipera aspic*), well known and dreaded in Illyria, Southern Hungary, &c. The latter is decidedly the more dangerous. At the same time, however, our attention has just been called to a reputed fatal case in England. A young man, named George Thompson, was bitten by a viper, whilst ascending Leith Hill, on July 27th, and died on the 29th notwithstanding medical treatment.

The section on vaccination and the small-pox may prove interesting during the present agitation anent the compulsory vaccination-laws. The author's views would scarcely, we fear, find grace in the eyes of the Local Government Board. He says—"No, vaccination does not place you in any case absolutely out of danger. Vaccinated, re-vaccinated, re-vaccinated again, you may still contract small-pox during an epidemic." These views, which are declared to be those of the highest medical authorities, certainly detract not a little from the glory popularly ascribed to Jenner.

On the sewage-question the author takes the opportunity of committing himself. He says—"Chemical processes of purification are costly and inefficacious. The sulphate of alumina, on which so much dependence has been placed, certainly clarifies sewage; the gelatinous alumina agglutinates the solid substances, but the dissolved matters, mineral and organic, are nowise retained (!) It clarifies; it does not purify." It is somewhat strange if chemists have still to learn that salts of alumina are perfectly able to precipitate not merely suspended, but dissolved organic bodies. Centuries of experience in dyeing and lake-making have put this beyond doubt. Nor must it be thought that colouring-matters are the only organic compounds capable of thus uniting with nascent alumina. It must further be remarked that in

the best precipitation processes the salts of alumina, iron, &c., are supplemented by bodies which have the power of absorbing and occluding the impurities, or of effecting their decomposition by the transfer of oxygen from the atmosphere.

The radiometer of Mr. Crookes is described and figured. Mention is made of the objection of Prof. O. Reynolds, and of the experiments by which it has been met. The author adds that M. Faye, a member of the Academy of Sciences, has long ago maintained that the rays of the sun were endowed with a repulsive force. Dr. Collongue, also, the inventor of the dynamoscope, published, about three years ago, a treatise on the attractions and repulsions of elder-pith under the action of solar heat and of that of the human body. "It is important to refer to these works from the point of view of historic truth, although they are not able to diminish the honour of Mr. Crookes's discovery."

The question of animal automatism, recently resuscitated, is also discussed here, and is very naturally extended from the rest of the animal kingdom to man.

We cannot further multiply extracts from this volume, but we have, we trust, furnished proof sufficient that it is replete with interesting and suggestive matter.

The Errors of Homœopathy. By Dr. Barr Meadows. London: G. Hill.

The fundamental principles of Homœopathy do not appear to advantage in the "fierce light" of Dr. Meadows's criticism. Still we may doubt whether many of the class who, as patients, put their faith in Hahnemann and his system will be either willing or able to follow the train of reasoning presented in this pamphlet. Perhaps for the general public the most telling argument against the view that the power of a medicine is increased by dilution or "attenuation" is the rejoinder that if that be the case the same must hold good with contagions. Yet they are universally allowed to be rendered less powerful and active, just as ventilation is more perfect, in other words just in proportion as they are diluted.

A majority of the believers in Homœopathy, however, will decline to discuss principles and confine themselves to the success of some Homœopathic practitioner or hospital. This argument is very fully met. In Fleischmann's celebrated Homœopathic Hospital, at Vienna, the mortality is actually greater than—in fact, nearly double—the average mortality of half a dozen English provincial infirmaries and hospitals. Yet in the former the proportion of really serious, not to say incurable, cases is much the smaller. Somewhat amusing are the two counter-testimonials at the close of the work. An amateur Homœopathist declares "it is a national calamity and nothing else when a doctor is converted." On the other hand, a qualified Homœopathic physician denounces the credulity of his amateur colleagues and laughs at their supposed cures!

The Calendar of the Tokio Kaisei-Gakko, or Imperial University of Tokio, for the year 1875.

The wonderful progress of the Japanese in Science and Industry has already attracted general attention, but many of our readers will doubtless be surprised to hear of the existence of a university so well organised and so amply fitted with every needful appliance. As a specimen of the arrangements we give some of the particulars of the department of applied chemistry, which is placed under the superintendence of Prof. R. W. Atkinson. Before entering this special department "the student must have completed the general course of study in the Kaisei-Gakko, or have passed a satisfactory examination in the English language, Inorganic Chemistry, Mathematics, and Elementary Physics." The course of study occupies three years and comprises the following subjects:—Analytical chemistry, chemical technology, metallurgy, and organic chemistry. In the first year the course of chemical technology includes the following subjects:—wood, peat, coal; charcoal, coke, gas, artificial illumination, tar, and its derivatives; by-products of the manufacture of coal-gas; products of the dry distillation of wood; acetic acid, naphtha; mineral oils, nitre, nitric acid, gunpowder; the alkali manufacture; sulphur, its distillation and purification; sulphuric acid, salt-cake, soda-ash, caustic soda, hyposulphite of soda, recovery of soda from waste products; hydrochloric acid, chlorine, and bleaching-powder; salts of potash and soda; magnesium and aluminium, iodine, and bromine. In the second year the student enters upon tinctorial chemistry, the manufacture of glass and earthenware, soap, wines, sugar, explosives, &c. As far as possible opportunity is given to the students to see the actual working of the processes whose principles they have under consideration.

The professors in the University are Europeans or Americans, but there is a regular staff of native assistants, and no doubt the services of foreigners will be dispensed with as soon as there are natives sufficiently trained for the purpose. The Japanese are far too astute not to see that the nation which relies upon foreign talent and invention must ultimately see its own children sink down to be "hewers of wood and drawers of water."

A laboratory sufficient for all present wants has been built and fitted up. It comprises a large analytical room, a convenient lecture hall, store-rooms, office, &c. Apparatus, both chemical and physical, seem to have been liberally supplied. The works on chemistry and physics in the University Library amount to 2697 volumes.

The arrangements for the study of biology are scarcely so complete, but we learn with pleasure that the students are encouraged to form botanical and zoological collections. We are suprised to find such an utterly unsatisfactory work as Guizot's "History of Civilisation" selected as a text-book in the course of instruction on history and philosophy. Will it be surprising if some day Japan should become one of the seats of research, whilst England, suffocated by competitive examinations, reaches that state of immobility which we once thought characteristic of the far East?

CORRESPONDENCE.

WELDON'S PROCESS FOR THE MANUFACTURE OF CHLORINE.

To the Editor of the Chemical News.

Sir,—In the portion of your translation of Dr. E. Mylius's contribution to Dr. Hofmann's "Report on the Development of the Chemical Arts during the last Ten Years," which appears in the Chemical News, vol. xxxiv., p. 33, Dr. Mylius says, with respect to the process for the manufacture of chlorine which bears my name, "the following account is founded partly on Mr. Weldon's paper in the Chemical News (vol. xxii., p. 145), and partly on his letter to Dr. A. W. Hofmann, dated March 12th, 1874." In the portion of the same translation which is given in the Chemical News, vol. xxxiv., p. 55, Dr. Mylius attributes to me, as having been made in the letter referred to, the statement that M. Kuhlmann, among others, was "preparing," at the date of that letter, to adopt the process in question; and on this Dr. Hofmann says in a foot-note:—"On September 18, 1874, I found in the establishment of M. Kuhlmann no preparations for the introduction of Weldon's process."

As I am thus made to appear in the *Berichte* and in your columns, as having written to Dr. Hofmann something which is not true, I am sure I shall not count in vain on

your permitting me to show how utterly unjust is the position in which that foot-note places me.

Here, Sir, are the *ipsissima verba* of what I said about M. Kuhlmann in my reply, written on March 12, to the letter which Dr. Hofmann had addressed to me on February 22, 1874:—"The process has also been adopted in France by the Compagnie de St. Gobain, and is *on the point of being adopted* by M. Merle, M. Kuhlmann, and other French manufacturers." I thus simply *did not use* the expression attributed to me by Dr. Mylius, to which Dr. Hofmann attaches his foot-note. And as regards the expression I did use, I can conceive no form of words more exactly fitting the facts as they stood then. M. Kuhlmann had accepted a license for the use of my process as early as April, 1870. He had not at that time actually determined to adopt my process, but was waiting, like so many others, to see the results of Mr. Deacon's. The time came, however, when, on each occasion of my visiting Lille, he spoke of the adoption of my process as a thing now settled and decided upon, to be carried into effect so soon as the necessary attention could be spared for it. Early in 1874, before the date of my letter to Dr. Hofmann, I had been shown the site in the works at Loos, which had been determined upon for my apparatus; I had had prepared, at M. Kuhlmann's desire, the drawings and specifications from which, with some modifications, the plant now at work there has since been built; I had been consulted as to whether certain existing vessels and constructions could not be turned to account for it, and it had been decided that some of them could and should be, and that others of them could not; and I had received repeated and positive assurances that the construction of the plant would be commenced either towards the end of the year then current, or at the beginning of 1875. Under these circumstances, I thought then, and I think now, that to say that M. Kuhlmann was "on the point of adopting" the process was to put the matter as accurately as it could be put without entering into unnecessary detail.

And surely, Sir, looking back now on what has happened since, it is plain that the expression which I used in March, 1874, has been justified by the event, notwithstanding that M. Kuhlmann was a year longer in getting to work than M. Merle, who was equally spoken of in the sentence in which that expression occurs. I believe that M. Kuhlmann's apparatus was not actually ordered until January, 1875; but I have before me as I write evidence that M. Kuhlmann had opened negociations with the Lancashire firm of engineers, of whom he eventually bought the mechanical part of it as early as July 17, 1874, so that this negociation had been commenced two months before that visit to Loos on which Dr. Hofmann "found no preparations for the introduction of Weldon's process."

Earlier even than that, namely, in the month of May—*four* months before Dr. Hofmann's visit to Loos, and only two months after my letter of March 12—at a meeting at Paris of the French Association of Chemical Manufacturers M. Kuhlmann had said—"Although I am myself the inventor of a process for the regeneration of manganese, I am going to employ, not my own process, but Mr. Weldon's."

In the face of these facts I cannot understand Dr. Hofmann's foot-note. That he "found" "no preparations," &c., is quite intelligible in the sense that he saw no new *constructions* on behalf of the process either in progress or completed; but how he failed to become informed of how far those "preparations" had been carried which necessarily precede constructive work is very puzzling. I am not concerned, however, with the *fact* stated in the foot-note, but merely with the manner of stating it. It is so put as to do me very serious injustice. I am quite satisfied that the injustice is wholly accidental; and the far higher qualities which we all know to be united with the splendid intellectual gifts of Dr. Hofmann, and which have made him for so many of us not only a hero but almost an idol, make it certain that the accident has not befallen through any lack of the most conscientious care. But the foot-note does me grave injustice all the same.

On another occasion I may ask your permission to point out certain errors into which Dr. Mylius has fallen in his account of the chlorine manufacture. Meantime I conclude by entreating of your courtesy that this letter may appear in your to-morrow's issue if possible.—I am, &c.,

WALTER WELDON.

Abbey Lodge, Merton, Surrey, August 17.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances, de l'Academie des Sciences. No. 2, July 10, 1876.

Influence of Physico-Chemical Forces on the Phenomena of Fermentation.—H. Ch. Bastian.—The author concludes from his experiments that the fermentation of urine is absolutely independent of germs which exist in the air.

Mineralogical Notices.—M. F. Pisani.—An account of the Amesite, of Chester (Massachusetts); Euchlorite, from the same locality: yellow Spessartine, of St. Marcel in Piemont; and Bastite from Elba.

No. 3, July 17, 1876.

Note on the Fermentation of Fruits, and on the Diffusion of the Germs of Alcoholic Ferments.—M. L. Pasteur.

Note on the Alteration of Urine, with reference to a Communication by Dr. Bastian.—M. L. Pasteur.

Intercellular Generation of the Alcoholic Ferment. M. L. Fremy.—These three papers are rather biological than chemical, and relate to the vexed question of spontaneous generation.

Fourth Note on Electric Transmission through the Soil.—M. Th. du Moncel.—Not adapted for abstraction.

Measure of Electric Resistance in Liquids by means of the Capillary Electrometer.—M. G. Lippmann.

Transformation of Saccharose into Reductive Sugar during the Operations of Refining.—M. Aimé Girard.—Among the impurities which have an effect on the yield obtained from crude sugars in refining, practical men place in the first rank the reductive sugar found among the products of the cane. Till lately it was admitted that this glucose by its mere presence threw a double proportion of saccharose into an immovable state. Doubts have latterly been thrown upon this explanation; the facts are beyond dispute. The author finds that saccharose is alterable not merely in an acid medium, but even in such as are neutral or verge upon alkalinity. Peligot has already pointed out that under various conditions glucose becomes converted into acid compounds, and in that state doubtless acts upon the saccharose.

Detection and Determination of Magenta and Arsenic in Wines Artificially Coloured.—M. C. Husson.—The author places a few grms. of the suspected wine in a phial, and adds a little ammonia, when the mixture turns a dirty green. He then steeps in the liquid a thread of white woollen yarn, withdraws it when saturated, places it vertically, and allows a drop of vinegar to flow along it. If the colour of the wine is natural, as the drop advances the wool returns to its original whiteness, but if the wine has been sophisticated with magenta it is dyed of a rose, deeper or paler. He has also examine

the physiological action of magenta free from arsenic, and finds that, though not a violent poison, it produces some morbid phenomena. In a state of chemical purity he considers that its use would not occasion any great inconvenience.

Circumstances of Production of the Two Varieties of Sulphur, the Prismatic and the Octahedral.—M. D. Gernez.—An account of the precautions to be taken in order to obtain sulphur in the two states mentioned.

Critical Researches on Certain Methods Employed for the Determination of Vapour-Densities, and on the Conclusions to be Deduced.—L. Troost and P. Hautefeuille.—Not adapted for abstraction.

Action of Hydracids upon Selenious Acid.—M. A. Ditte.—The author states that the compound $SeO_2,2HBr$ is capable of taking up more bromine, and forming the compound $2SeO_2,5HBr$. He has also examined the behaviour of selenious acid with the hydriodic, hydrocyanic, hydro-fluoric, hydro-sulphuric, and hydro-selenic acid.

Observations on Iodine as a Reagent for Starch.—M. E. Puchot.—The author finds that the sensibility of iodine as a reagent for starch is affected by certain nitrogenous organic matters, such as albumen. If albumen is poured upon iodide of starch suspended in water the colour disappears. If albumen is added to a solution of starch saturated iodine water produces no colouration.

Rhodeine, a New Reaction of Aniline.—M. E. Jacquemin.—The author having mentioned that the hypochlorites of lime and soda cease to indicate the presence of aniline in solutions containing less than 1 centigrm. in 500 c.c. of water, shows that if after adding the test solution of hypochlorite to these dilute solutions there be further added a few drops of dilute sulphide of ammonium (1 part to 30 of water) a splendid rose colouration appears. In this manner 1 part of aniline may be detected in 250,000 of water. He gives the name rhodeine to the colouring matter thus generated. No other oxidising agent can be substituted for the hypochlorites, and no colour is obtained if a sulphite or hyposulphite is used instead of a sulphide. Diphenylamin and toluydin similarly treated produce no such reaction.

Action of Water upon the Glycols.—MM. Nevolé.—Not adapted for abstraction.

Existence in Spain of a Bed of Nickel Ores Analogous to those of New Caledonia.—M. Meissonier.—The ore in question is found in the province of Malaga, and is a silicate of nickel free from cobalt, and, it is intimated, from arsenic and antimony. The amount of nickel is about 9 per cent.

Microzymas of the Bladder as the Cause of the Ammoniacal Fermentation of Urine.—M. A. Béchamp.—A controversial paper, with reference to the papers of Pasteur, Joubert, and Berthelot (*Comptes Rendus*, lxxxi., page 5.)

Gazzetta Chimica Italiana.
Anno vi., 1876, Fasc. iv.

On Hesperidin.—E. Paterno and G. Briosi.—The hesperidin examined by the authors was extracted from the fruit of the common orange (*Citrus aurantium*), but it is found also in *Citrus limonum*, *Citrus medica*, &c. From 4000 ripe oranges they obtained 180 grms. of pure hesperidin. Its analysis gave the following results:—

C	53·80
H	5·88

Of nitrogen there was not a trace.

Experimental Researches on Electrostatic Induction.—G. Pisati.—Not suited for abstraction.

Elasticity of Metals at Different Temperatures.—G. Pisati.—Not adapted for abstraction.

Bulletin de la Société d'Encouragement pour l'Industrie Nationale, No. 32, August, 1876.

Report of M. J. A. Barral on behalf of the Committee of Chemical Arts on the Pneumatic Malting Process of M. Galland, Introduced at the Brewery of Maxiville, near Nancy.—The principle of the invention consists in forcing air always at the same temperature and always saturated with moisture through the layer of barley with a speed exactly sufficient to remove the excess of carbonic acid. The barley may be spread to the depth of 30 to 50 c.m. The results are stated to be very satisfactory. From a statistical table given it appears that the average consumption of beer in Bavaria reaches the enormous amount of 219 litres per head, that of England being 118.

Report of M. Lamy on behalf of the Committee of Chemical Arts on the Manufacture of French Yeast and of Corn Spirit of Sprenger and Co., of Maisons Alfort (Seine).—Not adapted for abstraction.

Revue Universelle des Mines,
May and June, 1876.

This issue contains no chemical matter except a paper on the "Pyrites used in the Manufacture of Sulphuric Acid in France" taken from the *Comptes Rendus*, and already noticed.

M. Reimann's Farber Zeitung.
No. 25, 1876.

This issue contains a long leader on the condition o the dyeing trade in Berlin. According to the figures given a dyer loses on the average 53 pfennige (about 4½d.) on every kilo. of woollen yarn that passes through his hands. It is now nothing uncommon to dye living animals. Some time ago a lady of the demimonde drove four greys dyed a splendid magenta in the Bois de Boulogne. White lap-dogs are often seen with light blue, green, and rose tails. (We have often seen ducks dyed magenta.) The manufacture of eosin has been commenced by A. Poirrier, of Paris.

No. 26, 1876.

This issue contains a notice that the method of producing pittakall, a blue colouring matter obtained more than thirty years ago from beech-wood tar by Reichenbach, has been re-discovered by Grätzel, of Hanover. It has the peculiarity of being coloured blue by alkalies and orange by acids. The shades produced with it are as fast as those yielded by indigo.

No. 27, 1876.

Manufacture of Orchil Extract and Paste.—According to the process of Saroz and Chognard (French patent) the lichens are macerated for a quarter of an hour in water, to which a little hydrate of lime has been added, and are then heated in a closed vessel to 100° to 120° by the introduction of steam at a tension of several atmospheres. The duration of the heating as well as the temperature are modified according to the kind of lichens made use of. The purpose of this heating is the rapid and complete conversion of the lichen acids into orcin. The clear liquid is then separated from the undissolved woody matter by a filter, a hydro-extractor, or a press, and concentrated by evaporation. It is then mixed with ammonia, and put in a tightly-fitting vessel of iron or wood, into which oxygen is conducted. The formation of orcein is thus more rapid than on the common procedure, in which the extract is left to the action of the atmosphere. The oxygen prepared by the process of Tessié du Motay enters at the bottom of the vessel by means of a perforated tube: the portion not absorbed is conducted away by a second pipe passing through the lid, and may be reserved

for a second operation. The evaporating ammonia escapes through the same pipe, and is absorbed in water with a view to its being re-utilised. When the oxidation is complete, and the liquid contains an excess of ammonia, it is driven off by exposure to the air or by a gentle heat. To prepare orchil paste, the above-described extract, after concentration and mixture with ammonia, is thickened with a quantity of extracted lichens, and treated with oxygen. The closed vessel is provided with a mechanical agitator. When the oxidation is complete the paste is allowed to stand for some days exposed to the air, with occasional agitation.

No. 28, 1876.

This issue contains a paper on the depressed state of the tinctorial trades, and an announcement that Dr. Ferd. Springmühl is undergoing a prosecution for having insulted Prince Bismark and the Emperor ("*Ego et rex meus*").

An establishment has been opened in Belgium for extracting the wool from grease by means of alcohol and ether. The yield, according to preliminary experiments, is understood to be large. Similar attempts with other liquids, *e.g.*, bisulphide of carbon and fusel oil (Richter's process), have failed owing to the escape of the solvents.

No. 29, 1876.

This issue, again, contains complaints on the depressed state of the dyeing trade in Berlin and the unremunerative scale of prices.

Consumers of vanadium salts are cautioned against tasting any mixtures in which such are present, or bringing them in contact with any part which has been deprived of the cuticle, as they are intensely poisonous. Prussiate of potash and tannin are proposed as antidotes.

MISCELLANEOUS.

University of London.—Several important changes have been made in the regulations for the degrees of Bachelor and Doctor in Science, conferred by the University of London. In the Matriculation examination German may now be substituted for Greek. In place of the superficial acquaintance with both Zoology and Botany, formerly required at the first B.Sc. examination, there will be a single examination (written and practical) in General Biology, in which a more thorough knowledge will be required of the simplest forms and elementary phenomena of Animal and Vegetable Life, such as is now made the basis of the teaching of some of the most distinguished professors in each department. Thus the student who may be intending to devote himself specially to Physical or Chemical Science, will be brought to apprehend the general conceptions common to the two great Organic Kingdoms, without being required to master the specialities of either. And the student who intends to present himself at the second B.Sc. examination in either Physiology, Zoology, or Botany, or all combined, will have laid the best foundation for those special studies in the study of General Biology. The regulations for the second B.Sc. examination are framed with the view of allowing the candidate to bring up *any three* of the following nine subjects:—

1. Pure Mathematics.
2. Mixed Mathematics.
3. Experimental Physics.
4. Chemistry.
5. Botany, including Vegetable Physiology.
6. Zoology.
7. Animal Physiology.
8. Physical Geography and Geology.
9. Logic and Psychology.

It is intended that the examinations in these several subjects should be, as nearly as may be, on the same grade, as to the amount of attainment they require. The experience of the Examiners in Mathematics justifies them in stating that any candidate who has thoroughly mastered the Mathematics of the first B.Sc. examination, and who has such an aptitude for the study as would lead him to select Pure Mathematics as one of his subjects at the second, would find no difficulty in mastering the requirements of its programme, by such an amount of study, carried on through an eight months' Academical Session, as would leave him free to bestow the same amount of time and attention on *two* or even *three other* subjects. It is understood the amount of proficiency expected in each of the three subjects chosen will be that which the candidate might attain by the steady devotion to it of about one-third of the sessional work of a diligent student. In regard to the Doctor's degree a change has been made in favour of candidates who prolong the interval between their first and second examinations for the degree of Bachelor from one year to two or more; as such will be allowed to come up for the degree of Doctor of Science within a year of their attaining the degree of Bachelor. We shall refer at greater length to the new regulations in our Student's Number, which will be published on September 15.

Analysis of the Weissenburg Water.—The springs of Weissenburg, in the Bernese Oberland, enjoy a considerable reputation as useful in the treatment of pulmonary affections. Cavities in the lungs are said to become cicatrised by its use. Its chemical composition can scarcely be said to throw much light upon its medicinal efficacy. The two main ingredients, according to Dr. Stierlin's minute and evidently careful examination, are sulphates of lime and magnesia. Lithium is present as chloride and iodide, the latter only in very minute quantity. There is an organic compound having the odour of blackberries, and also cæsium and rubidium in traces too small for quantitative determination.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

Improvements in the production of white lead and in the apparatus employed therein. L. Brumleu, Newcastle-on-Tyne. April 20, 1875. No. 1437. The essential features of this invention consists in first effecting the division of the lead to be converted into white lead, and then subjecting the same contained in a suitably arranged chamber to the action of either acetic acid or of acetate of lead, or of mixtures of the same, and also to the action of air and of carbonic acid; the chamber or chambers being so constructed that a rocking motion may be given to them in order that the white lead formed upon the surface of the lead may be removed by the action of the solution contained therein, and a fresh surface be thereby exposed.

Improvements in the treatment and preparation of certain chemical compounds for the purpose of rendering their carriage, sale, use, and application more convenient and economical. T. Hyatt, Gloucester Gardens, Hyde Park, London, Middlesex. April 21, 1875.—No. 1451. My invention relates to the consolidation of chemical substances, such as sal-soda, alum, and other compounds containing water of crystallisation, for the purpose of lessening their bulk, and thus diminishing the cost of packing, handling, and carriage, and also for the purpose of preventing the waste which arises when such substances are in powder or in crystal form; also to make their employment in domestic use, and in the arts and manufactures, more precise, convenient, and economical. My invention also relates to the consolidation of materials other than the above, when such materials are joined, mixed, combined, connected, or united to them in the production of new and useful manufactures, such as soda and sedlitz powders in medicines, and such as fireproof compositions, or compounds in the manufacture of fireproof safes, and in the protection of buildings or other constructions against fire.

Improvements in the manufacture of manure from certain mineral phosphates. P. Spence, Newton Heath, Manchester, Lancaster. April 21, 1875.—No. 1455. This invention relates to a method of treating phosphates of alumina, or phosphates of alumina and iron, whereby valuable manure is obtained. The substance chiefly used is that called Redonda phosphate, and the treatment thereof is an improvement upon that method for which a Patent was granted to the present inventor, dated June 9, 1870, No. 1676.

Improvements in the manufacture of artificial fuel. C. Kingsford, Fulham, Middlesex. April 21, 1875.—No. 1456. This invention mainly consists in consolidating small coal or slack, or similar substances, by addition thereto of a composition made of a solution of silicate of soda or potash, to which a small quantity of pitch or other suitable substance is added, and to enable the pitch to combine with the solution the silicate is heated with a small quantity of flour or suitable paste-making materials to convert it into a paste, and while hot the pitch is added. For consolidating the substances the composition while hot is submitted to pressure. The coal may be ground, and, if desired, mixed with clay and lime, which react upon the silicates, and hasten the solidification of the fuel.

Improvements in the manufacture of manure, and in the apparatus employed therein. J. H. Johnson, Lincoln's Inn Fields, Middlesex. (A communication from H. O. P. Lissagaray, Pantin, France.) April 22, 1875.—No. 1484. This invention relates to the manufacture of soluble and putrescible manure from new products obtained by the special treatment of nitrogenous substances, such, for example, as leather, wool, and horn, which in their natural condition are insoluble and imputrescible, and also to apparatus to be employed in operating upon the before-mentioned substances.

Improvements in the manufacture of glucose or grape-sugar from rice or other grain. E. E. Pearse, Oberstein Road, New Wandsworth, Surrey. April 23, 1875.—No. 1489. This invention has reference to Letters Patent, No. 1044, 1873, and relates to the use of a small jet of water or other suitable liquid to flow in with the grain as it passes into the saccharifier through the feed-trough to prevent any tendency to choking. By these means the operation on broken and refuse grain, as well as the operation on grain that has previously been reduced to small particles or powder, is facilitated.

Improvements in the manufacture of perforated blocks of chloride of sodium or chloride of potassium for use in the manufacture of sulphate of soda and sulphate of potash. J. Brock, Widnes, Lancashire. April 23, 1875.—No. 1502. This invention consists in making perforated blocks of the salts named by placing the crystals wet from the boiling pans in frames filled with taper pegs, and then draining, turning them out of the frame, and stoving them.

Improvements in the method of, and apparatus for, purifying carburetted hydrogen gas. H. W. Cook, Thurloe Square, Middlesex. April 23, 1875.—No. 1505. The objects of this invention are to economise the chemical ingredients employed for the purification of gas. To this end the purifying materials (say lime, for instance) are presented to the gas in such a manner that they will act energetically on the gaseous impurities, and will offer continually fresh absorbing surfaces.

Improvements in the manufacture of sugar from sugar-canes, and in apparatus to be employed therein, which apparatus is also applicable to other like purposes. B. Hunt, Serle Street, Lincoln's Inn, Middlesex. (A communication from A. F. C. Reynoso, Paris.) April 28, 1875.—No. 1558. This improved process is essentially different from all those which are now employed, and consists in the complete extraction of the juice from the sugar-cane or sorghum. For this purpose, instead of rolling the canes or sorghum in a mill, the inventor commences by cutting them in pieces by means of cutters or knives suitably arranged; these pieces are then reduced into a pulp by means of rasps, millstones, revolving cylinders, or plates, or other mechanism or apparatus adapted to lacerate the cellules in order to obtain by the complete crushing thereof a homogeneous paste. The pulp thus obtained is submitted to the action of the ordinary presses, or hydraulic or other presses, or any other process employed to separate the juice therefrom. This apparatus may also be employed for the extraction of starch from tapioca and other roots, and for the reduction to pulp of cocoa-nuts and other fruits, or for the treatment of sorghum or maize, either for the extraction of sugar or the preparation of food for animals.

Improvements in apparatus or appliances employed in the manufacture of sulphates of soda and potassa. J. Hargreaves and T. Robinson, both of Widnes, Lancaster. April 29, 1875.—No. 1576. This invention relates to our direct-action process for the production of sulphates of soda and potassa, and consists—(1) In the employment of an overhead steam or other crane for charging the chambers. (2) In using the said crane in combination with a weighted or other tool for loosening the sulphate in the chambers. (3) In employing a revolving shaft provided with expanding cutters to loosen the sulphate. (4) In employing troughs or endless travelling bands to carry away to the desired place the finished sulphate. (5) In lengthening the filling necks, and filling the intervening spaces with non-conducting material to form a working floor and prevent radiation. (6) In forming the hydrochloric gas flues of iron to prevent leakage.

Improvements in dyeing or printing. C. A. Martius, Berlin, Prussia. April 29, 1875.—No. 1584. This invention relates to improvements in dyeing or printing with aniline and other coal-tar colours without the use of mordants now necessary when those colours are employed, by the employment of the fatty salts of the bases of the aniline colours, or the other basic coal-tar colours dissolved in alcohols or in the hydrocarbons of the benzol and petroleum series, the above-mentioned salts being insoluble in water.

Improvements in treating slag from blast-furnaces to produce a new article of manufacture. E. T. Hughes, Chancery Lane, London. (A communication from M. E. Bergius, Mannheim, Baden.) April 30, 1875.—No. 1595. This consists in treating slag with a blast of steam so as to transform it into a cotton-like state, which is called silicate cotton.

An improved process for the manufacture of red sulphide of mercury. A. M. Clark, Chancery Lane, Middlesex. (A communication from W. J. S. Grawitz, Paris.) April 30, 1875.—No. 1604. The invention consists in manufacturing red sulphide of mercury by dissolving without the aid of heat, and whilst protected from the action of light, either the binoxides of mercury or the salts of the binoxide of mercury in a soluble hyposulphate, the precipitate obtained being gradually raised in temperature in order to deposit the sulphide of mercury.

Improvements in the production of aniline-black for printing and other purposes, and in dyeing aniline-black. A. M. Clark, Chancery Lane, Middlesex. (A communication from W. J. S. Grawitz, Paris.) May 1, 1875.—No. 1620. This invention relates to the production of aniline-black, first, in the form of a paste or powder for printing purposes, and for the manufacture of colours, varnishes, and inks of all kinds; and, secondly, the fibres of textile fabrics, by the concurrent reaction on aniline oil of certain metallic salts, and certain chromates or bichromates.

An improved method of and apparatus for filtering and deodorising sewage so as to prevent rivers being polluted thereby. T. Pape, Great Alfred Street, Nottingham. May 3, 1875.—No. 1625. The chief features of the invention consist in a machine being placed horizontally on a shaft driven by steam-power, and when once set in motion the apparatus is self acting, and never need stop except for repairs.

Improvements in the manufacture of chlorine. H. Deacon, Appleton House, Widnes, Lancaster. May 5, 1875.—No. 1632. The essential feature of this invention consists in the employment in what is known as Deacon's chlorine process of the residue of burnt or calcined pyrites or sulphurets of iron, such residues being either impregnated with a salt of copper, or the copper contained therein, being rendered soluble and active either by means of water or by means of an acidulated solution.

Improvements in the manufacture of sulphuric anhydride. E. Sonstadt, Highgate Road, Middlesex. May 3, 1875.—No. 1638. This invention consists, first, in substituting anhydrous sulphate of magnesium for the ordinary ferric sulphate or other like substance usually employed in manufacturing or obtaining sulphuric anhydride. At about the melting-point of cast-iron, the anhydride is completely driven off, and may be condensed in the usual manner. This invention consists, secondly, in using ordinary magnesium sulphate for the same purpose. The water of crystallisation is first completely driven off at a temperature below a red heat, then the heat is raised, and the process is continued as in the first part of the invention.

Improvements in the method of treating grease for the purification thereof, to be used in the manufacture of soap and for other purposes. J. Hopkinson, Southfield Square, Bradford, York. May 5, 1875.—No. 1667. Of the grease to be purified I make a lime or insoluble soap, and dissolve out the impure fat with a suitable solvent: I prefer bisulphide of carbon applied under pressure or otherwise. The same is run into a still, and the bisulphide of carbon is distilled off, leaving the impure fat in the still. The fatty acids distilled are decomposed by means of heat and I prefer hydrochloric, which liberates the fatty acids from the lime base.

Improvements in the manufacture of artificial fuel. J. Deere, Brighton, Sussex. May 5, 1875.—No. 1680. The fuel is composed of coal, lime, clay, gypsum, or copperas, mixed with a gelatincus solution.

Improvements in the purification of gas. J. Whitley, Roundhay, York. May 6, 1875.—No. 1694. This invention describes a means of purifying gas by filtering it through layers of cotton-wool or other fibrous material.

Improvements in apparatus for utilising inflammable fluids for illuminating and heating purposes. H. Browne, Raymond's Buildings, Gray's Inn, Middlesex, May 7, 1875.—No. 1701. This invention has for its objects the improvement of the means of employing inflammable fluids, such as petroleum, naphtha, and the like, for illuminating and heating purposes, and also the rendering the employment for such purposes of such inflammable fluids less dangerous, and consists of an arrangement of reservoirs, pipes, and cocks for supplying the fluid to the lamps or other apparatus automatically.

Improvements in the treatment of substances containing alumina and iron for the purpose of obtaining certain useful substances therefrom. P. and F. M. Spence, Newton Heath, Manchester. May 7, 1875.—No. 1703. This invention relates to the production of a cake of sulphate of alumina and iron from minerals known under the name of bauxite.

A new or improved process for oxidising anthracen, and improvements in the colouring matter produced therefrom. C. Heinzerling and G. McGowan, Glasgow, Lanark. May 8, 1875.—No. 1716. The features which constitute this invention are the treatment of anthracen with bleaching-powder, and dilute or non-dilute hydrochloric or equivalent acid, and treating alizarin with cyanide or sulphocyanide of potassium.

Improvements in the manufacture of soda. J. Mactear, Glasgow, Lanark, N.B. May 8, 1875.—No. 1714. This invention relates to an improved combination of processes whereby in the manufacture of soda a part of the operations hitherto required may be dispensed with, whilst soda sulphate is more completely separated from the products and profitably utilised.

Improvements in the manufacture of sugar. A. Manbré, Cleveland Villas, Penge, Surrey. May 8, 1875.—No. 1724. My invention has for its object improvements in the manufacture of glucose-sugar for brewing purposes. I have found that by mixing a portion of cane-sugar with a portion of glucose-sugar, and by subjecting the mixture to the action of heat and in a vacuum, I am able to produce a new kind of sugar, which I call a "specialite sugar," for making beer, possessing all the properties required for producing bitter, India, and other pale ales, common beer, stout, and porter of the finest and purest quality, possessing great fullness and great delicacy of flavour.

Improvements in the production of compounds containing xyloidine, and in the application of the same. D. Spill, High Street, Homerton, Middlesex. May 11, 1875.—No. 1739. This invention relates to improvements in the production and application of xyloidine, and of those compounds which consist essentially of what is known as soluble gun-cotton, specially applicable to the manufacture of fusees, fusee tubes and imitation tortoise-shell or turtle-shell.

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METACHROMATISM, OR COLOUR CHANGE.

By W. ACKROYD, Mem. Phys. Soc.

Many inorganic bodies change colour, when they are heated, without suffering any alteration of chemical composition. These changes embrace a class of phenomena quite as important in their way as those of phosphorescence and fluorescence, with which, in fact, they are intimately connected. We venture, therefore, to propose for the phenomenon the name of *Metachromatism*, from the Greek μετα, *change*, and χρωμα, *colour*, and it will be convenient to call colour-changing bodies *metachromes*.

Metachromatism has received a fair share of attention from scientific men in time past. Their labours, however, are not even referred to in our text-books of chemistry and physics,—perhaps from the importance of the subject being under-rated, and its bearings not being clearly seen. Hence when, at an early stage in its study, we saw that *nearly all metachromatic changes take place in a definite order, the order of the spectrum colours*, we were under the impression, even after much reading, that the subject was quite unworked.

Stahl and followers made note of the chameleon-like behaviour of certain metallic oxides, and Schönbein,* who studied the subject, inferred from his observations that heat imparts a darker colour to metachromes, and generally red or brown. Sir David Brewster† called attention to the change in the absorption-bands of nitric peroxide when that body is subjected to heat, and twenty years later (1857) Gladstone made observations‡ on the change of colour in salt solutions upon elevation of temperature. He observes that whilst some really exhibit colour change, in others there is simply an alteration of the intensity o the transmitted light. Houston and Thompson,‖ in a paper wherein no reference is made to prior workers, clearly enunciate the order of change given above.

Hartley§ has made observations on the action of heat on the absorption spectra and chemical constitution of saline solutions. In the substances he has studied he regards colour-change as evidence of alteration of hydration.

I. *Metachromes, their Deportment and Classification.*

A large series of spectroscopic observations were made of metachromatic solutions, at low and high temperatures, for purposes of comparison. The change in most cases is very small, and may readily be confused with sources of observational error. Our main object being to arrive approximately at the cause of the phenomenon, solutions were discarded, and stable anhydrous bodies experimented with in their stead. The advantages accruing from this course are many, and such a course is moreover necessary for (1) the elimination of chemical action, and (2) a more decided change in colour, from the greater range of temperature it is possible to employ. The table below contains a list of a few anhydrous metachromes, with their changes, in addition to many of those given by Schönbein, Gladstone, and Houston and Thompson.

The changes were observed on white porcelain in preference to sheet copper, as used by Messrs. Houston and Thompson. This metal at the temperatures employed is soon covered with a film of suboxide, and the play of colours on its surface, unavoidably produced by variation of temperature, can scarcely fail to give a wrong impression of the change in the metachrome under observation.

The behaviour of mercuric oxide calls for a few remarks, since here decomposition was observed at a comparatively low temperature. Resolution commenced at 230° to 232° C., 760 m.m. bar., metallic mercury being deposited in the cooler parts of the containing tube as a scarcely perceptible film, in which globules could only be made out with the aid of a lens.

Table I.—Metachromatic Changes.

Metachrome.	Normal Colour.	Change.
Mercuric oxide	Orange-yellow.	(In N, air, and CO_2.) Orange, red, and brown.
Zincic oxide	White	(In N, air, and CO_2.) Yellow and orange.
Cinnabar	Scarlet	(In sealed tube.) Dark scarlet and puce (240° C.).
Mercuric iodide	16° C., Red	Dark red.
" "	140° C., Yellow	(In sealed tube.) Orange and red. (The same change under paraffin.)
Manganous oxide	Greenish grey	(In hydrogen.) Greenish yellow.
Plumbic oxide	Yellow	(In air and CO_2.) Orange and red.
Chromic oxide	Green	Yellow, and when cooling just after the 'glow' of a bluish cast.
Manganates of potash and soda	Bluish green	Perceptibly greener.
Red oxide of manganese	Reddish brown	Nearly black.
Thallious iodide	Yellow	Orange-yellow, changes suddenly to orange-red.
Sesquichloride of thallium	Yellow	Orange and orange-red.
Thallious bromide	Yellowish white	Yellow and orange-yellow.
Terchromate of thallium	Orange-red	Red and dark red.
Neutral chromate of thallium	Orange-yellow	Orange, red, and deep red.
Metaborate of copper	Blue	Green and greenish yellow.
Porcelain	White	Yellow.
Suboxide of copper glass	Scarlet	Blackish red and black.
Chromate of barium	Yellow	Orange.
" of lead	Orange	Brick-red and black-red.
Plumbic iodide	Orange-yellow	Orange and red.
Argentic iodide	Yellowish white	Greener cast; and from 105°°—116° C. to fusing-point, orange, red, and dark red.
" phosphate	Yellow	Orange and reddish brown.
Potassic dichromate	Red	Dark red.

* Point of maximum density (Rodwell).

* Gmelin's "Chemistry," vol. i., p. 235.
† *Proceedings of the Royal Society*, vol. cxxviii., p. 247.
‡ *Phil. Mag.*, vol. xiv., p. 423.
‖ *Journal of the Franklin Institute*, October, 1871, and Chemical News, vol. xxiv., pp. 177 and 188.
§ *Proceedings of the Royal Society*, No. 161, 1875.

To ascertain the more intimate nature of the change in these anhydrous bodies was a work of some difficulty until the following simple expedient was devised:—Crystalline metachromes were used. The finely-powdered body was placed upon the concave side of a watch-glass, and pressed into a thin layer by the convex side of a second glass. The spectrum of the transmitted light being obtained at the normal temperature, the temperature was now raised, and a second spectrum obtained for comparison. Such a comparison for potassic dichromate we have in the following figure:—

It will be observed that upon elevation of temperature the absorption-bands at the ends of the spectrum widen out, and *the more refrangible increment of absorption is nearly double that of the less refrangible*. From the last observation the spectral order of change characteristic of metachromatism follows as a natural consequence, the less refrangible constituents of a body's reflected light being, so to speak, more persistent than the more refrangible during elevation of temperature.

In a certain class of bodies, like ZnO, the spectrum order of change is not so evident, from the fact that white has strictly no place in the spectrum. To this class belongs such bodies as TiO_2, Ta_2O_5, MoO_3, Sb_2O_3, Sb_2O_4, SnO_2, white porcelain, lead glass, colourless solution of ferric nitrate, and nitric peroxide at low temperatures, which, being white or colourless, become yellow upon elevation of temperature. In another and larger class, of which borate of copper and plumbic oxide may be taken as examples, the spectrum order is very evident. Both classes alike owe their change to increased absorption of light, with elevation of temperature; and a white body, if the temperature be raised high enough, may be made to pass not only from white to yellow, but also from yellow to orange, and thus the line of demarcation between the two classes is broken down. Reflecting upon these facts, we see that it is possible to arrange the colours in order: this we have done as follows:—

Metachromatic Scale.

The position of all the members, save the lowest three, is determined by experiment. That white has the position we give it seems probable because—(1) by experiment with the ZnO class of metachromes it plainly occupies a position at the opposite end of the scale to orange and red; (2) the behaviour of blue and green metachromes precludes its being placed between these two colours; and (3) it is the direct opposite of black. Violet and indigo are only placed in the scale provisionally to make up the spectrum colours, as there are no experiments to warrant their being so placed.

The metachromatic scale may be looked upon as showing the colour effects of expansion on the one hand, or of contraction on the other. And were it possible to reach the absolute zero of temperature we should probably have there colours of the white end of the scale.

II. *Theories of Metachromatism.*

Stahl and followers connected colour-change with the varying amounts of phlogiston a body was supposed to contain when being heated. Schönbein supposed the metachromes underwent what he termed an incipient decomposition,—*i.e.*, one of the elements was supposed to be held in a peculiar state of combination whilst hot, and to regain its normal position upon cooling. Mercuric oxide, for example, was thought to assume the brown-black colour of the suboxide from losing a part of its oxygen, which was retained in a peculiar manner in the mass. Now mercuric oxide, from being an exception to a law which we shall presently state, appears to favour Schönbein's hypothesis. When we think, however, over the fact that this oxide is partially decomposed at 232° C., whilst it is in the *deep orange* state, we see that no suboxide is really formed.

It is difficult to see how the hypothesis can apply in the case of borates, phosphates, and silicates. That it does not hold with binary compounds will be evident after a consideration of the following law, which we discovered during our study of this subject:—*In a series of anhydrous binary compounds of the same two elements, those which have the highest amount of the basylous element have the most refrangible colours, and*, vice versâ, *those which have the least amount of the basylous element have the least refrangible colours*. The table below illustrates this, and it will be found to hold good in many more anhydrous series than are given here.

From the table it is evident that decomposition (incipient or complete) of any particular compound would give us more refrangible colours instead of the less refrangible, which is the result of elevation of temperature, —*e.g.*, *incipient* decomposition of the brown $PtCl_4$ would give us the more refrangible green $PtCl_2$.

It is not our intention here to enter minutely into Messrs. Houston and Thompson's theory: the reader is therefore referred to their paper in the CHEMICAL NEWS (vol. xxiv., pp. 177 and 188). We note that (1) no men-

Table II.—SHOWING COLOUR RELATIONS OF ANHYDROUS BINARY COMPOUNDS.

Metachromatic Scale.	Each Series arranged Vertically											
Black ..	$\ddot{A}u_2S_3$			InO_2	CuO	MnO_2	Ni_2O_3			Co_3O_4		Pb_2O (?)
Brown..	Au_2S		CuS_2			Mn_3O_4 & Mn_2O_3		Au_2O_3	CdO			PbO_2
Red ..	$PtCl_4$	Bi_2O_3			Cu_2O				$AuCl_3$	HgI_2	CrO_3	Pb_3O_4 Fe_2O_3
Orange												
Yellow		Bi_2O_3		In_2O_3					AuCl	Hg_2I_3		PtO FeO Sb_2O_5
Green ..	$PtCl_2$			In_4O_5		MnO	NiO	Au_2O	Cd_2O	Hg_2I_2	CoO	Cr_2O_3
Blue ..												
Indigo..			$\ddot{C}uS$ (Ind. copper)									
Violet ..		$Cr_2\dot{C}l_6$										
White or Grey (Metal)		$\ddot{C}rCl_2$		In_7O_9								Sb_2O_3

tion is made of the part absorption takes in this phenomenon, probably arising from their not having studied the subject spectroscopically; and (2) that they speak of metachromes as if generating light after the manner of incandescent bodies. That absorption plays an all-important part will be evident from what we have said in Section I., and that vibratory motion has little, if anything, to do with metachromatism we hope to make clear in the sequel.

Our experiments demonstrate that metachromatism does not depend upon the surrounding medium, for bodies exhibit the change alike in nitrogen, air, carbonic anhydride, and hydrogen. It has been suggested that the phenomenon might in some way be due to volatilisation. A volatile body, however, exhibits the change under a liquid medium. Hence we conclude that it is due in some manner to the action of heat on the internal structure of the metachrome. Metachromatism is seen in solids,—amorphous and crystalline,—in liquids, and in gases near their liquefying points (N_2O_4 and Br_2*). These forms of matter have molecular structure in common; hence we attribute metachromatism to molecular alteration. What the nature of this alteration may be we think will be manifest after a close consideration of certain physical facts.

Absorbed heat performs two kinds of work:—

i. Kinetic, sensible to the thermometer, and—

ii. Potential.

α. The overcoming of cohesion, molecular recession, or molar expansion, as, *e.g.*, the conversion of ice into water, and water into steam. *This kind of work is accompanied by a change of density.*

β. The overcoming of chemical attraction, atomic recession, or molecular expansion, which finally ends in decomposition, as, *e.g.*, the resolution of $PtCl_4$ in $PtCl_2$ and Cl_2.

I. It is a fact well known to mineralogists that many anhydrous silicates, after being subjected to a high temperature, have upon cooling permanently changed colours. This is shown in the following table† in each example save that of olivine.

	Density before Ignition.	After Ignition.
1. Olivine ..	Pistachio-green, 3·389	Pist.-green, 3·378
2. Beryl ..	Straw-yellow, 2·697	Blue, 2·697
3. Topaz ..	Sherry „ 3·539	Pink, 3·533
4. Zircon ..	Brown, 4·515	White, 4·540
5. „ ..	Aurora-red 4·863	Colourless, 4·863

It will be noted that where colour and density are both permanently altered, as in 3 and 4, the warm-coloured variety is less dense than the same mineral with a cold colour,—*i.e.*, the densities are in the order of the metachromatic scale, a fact we anticipated in our study of this matter. This is also strikingly evident among allotropes, the notable exception being here, as elsewhere, that of phosphorus. Red amorphous phosphorus is denser than the yellow: this very fact, however, will no doubt tend to throw light on some of its other anomalies. What we more especially call attention to here is, that bodies of identical chemical composition, without even a change of density in some cases (as in 2 and 5), may at the *same temperature* have different colours,—*i.e.*, may absorb light in different degrees. From this we conclude that change of colour is not due to alteration of sensible heat.

Perhaps we get a better illustration of the same fact in the behaviour of mercuric iodide. Examined spectroscopically at say 16° C., a band of red light is transmitted, extending from B to D. This narrows as the temperature rises; in other words, there is an increase of absorption up to about 140° C. The band of transmitted light now suddenly widens, and extends to a little beyond *b*. As the temperature is on the rise there is still a gradual increase of absorption, but at 220° C. there is not so much light absorbed as there was at 16° C. From this we again infer that absorption of light at comparatively *low temperatures* is not dependent upon sensible heat or vibratory motion.

II. Expansion by heat—*i.e.*, decrease of density—is an all but universal law so far as we at present know. There are several exceptions, however, and many of these are among the silicates. Their anomalous behaviour is, as a rule, pointed out by the colour-change, as in the case of the zircon. This is not always the case, for there may be change of colour, as in the beryl, without alteration of density—*i.e.*, without appreciable molecular approach or recession. On the other hand, we have in olivine an example of change of density, molecular recession, without a corresponding alteration of colour. More facts of the same nature might readily be adduced, from which we infer that molar expansion or contraction is not a necessary concomitant of metachromatism.

We have, so far, excluded from our list of possible concomitants i. and ii. *α*: hence we are driven to the conclusion, backed by facts which space will not allow us at present to detail here, that the only necessary concomitant is ii. *β*,—*i.e.*, atomic approach or atomic recession; in other words, alteration of atomic potentiality.

From the foregoing observations we learn—

(1). That metachromatism arises from increased absorption of light with elevation of temperature, the more refrangible increment increasing at a greater rate than the less refrangible.

(2). That the only necessary concomitant is alteration of atomic potentiality; a change from the white towards the black end of the metachromatic scale signifying atomic recession, and a change from the black towards the white end atomic approach.

(3). That where this change of potentiality goes far enough to affect chemical attraction sufficient to induce chemical action, then, for bodies obeying the law of colour sequence, a change of colour from the white towards the black end of the scale indicates combination, and the opposite order resolution into a lower compound.

For much help received in this study of metachromatism our thanks are due to Dr. Frankland and Mr. Wm. Valentin.

* Dr. Andrews.

† Compiled from "Some Experiments on the Density of Garnet, &c." (Church), *Chem. Soc. Jour* vo xvii., pp. 386 and 415.

ON THE ESTIMATION OF COLOUR IN WATER.

By CHARLES A. CAMERON.

IN "Nesslerising" water it has been proposed to use solutions of caramel instead of standard solutions of ammonia for the purpose of comparison. I have, as well as other chemists, found that the standard solution of caramel, even when it contains much alcohol, becomes, after a time, turbid and useless, and also that it soon changes its hue. I do not think that the use of any coloured solution is so reliable as that of the standard solutions of ammonia; but to those who prefer the former I would recommend the use of coloured discs to be employed as follows:—Fill a Nessler tube with distilled water and place it over a disc so coloured that on looking down through the column of water it may, by the reflected light from the disc, have the colour of a solution of say 0·005 gr. of ammonia per gallon of water mixed with the usual 5 per cent of Nessler's solution. A dozen discs would be sufficient; but in using them, Nessler's solution should be always of exactly the same composition. I would suggest that Mr. Sutton, who is so valuable an ally of the chemists who have not time or inclination to prepare their solutions, &c., might make a set of cylinders, discs, and solutions, in harmony with the above suggestion.

ON SOME CHEMICAL RESEARCHES ON THE PRESENCE OF COPPER IN CAST-IRON.

By SERGIUS KERN, St. Petersburg.

It is well known that wrought-iron containing some tenths of per cent of copper is red-short; meanwhile in some of the best irons from Siberia was found from 0·01 to 0·03 per cent of copper. In some specimens of steel I found 0·2 per cent of copper; this steel was not brittle, and had been used with success for manufacturing steel axles. The presence of copper was found in several specimens of cast-iron coming from blast-furnaces of the South Oural mountains. These specimens, when examined and analysed, showed that the presence of copper in cast-iron may amount to a higher percentage than in steel or iron without altering the quality of the metal. Unfortunately it is not so with wrought-iron or steel. The specimen examined was much used for castings; it filled up the moulds beautifully, and had a very handsome appearance; fresh cut it had a dark grey colour. Under the microscope small grains of copper were easily remarked in the mass of the metal. This peculiar sample of cast-iron was carefully analysed, and the analysis gave the following average composition:—

	Per cent.
Iron	83·514
Copper..	8·123
Tin	1·252
Cobalt	0·501
Silicium	0·052
Tungsten	0·125
Carbon..	3·001
Manganese..	2·312
	99·780

While analysing some iron samples for copper I often used, in case only traces of copper could be detected, the following method:—The specimen is dissolved in hydrochloric acid, and the copper and iron are precipitated by an excess of ammonia; the mixture is boiled and filtered; the blue liquor is evaporated nearly to dryness, and the resulting residue is dissolved in sulphuric acid. Into this solution a piece of magnesium ribbon is placed, which, in case of traces of copper, is quickly covered with a layer of this metal; that is easily observed under the microscope.

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 67.)

Chlorine, Bromine, Iodine, and Fluorine.

By Dr. E. Mylius, of Ludwigshafen.

After the mixture of hydrochloric acid and air has left the regulator, by its basis, it arrives in the decomposing furnace. This consists of a cast-iron box in which are nine chambers arranged in a horizontal plane, each of them provided with a grate or false bottom at its lower part. Upon this grating stand, in the first, and also in the second chamber, vertically arranged drain-pipes which have been plunged into a hot concentrated solution of 2 mols. copper sulphate and 3 mols. sodium sulphate, and then dried. The remaining chambers are filled with fragments of bricks or balls of clay (1·5 centimetres) which have been treated in the same manner with sulphates of copper and of soda. The entire furnace is surrounded with an air jacket and this again with a screen of masonry traversed by flues, which has the object of keeping back a part of the heat which would otherwise be lost by radiation. Another portion is supplied by the heat generated in the process by the combustion of the hydrochloric acid. The above-mentioned vertical drain-pipes serve to prevent the apparatus from being choked up with oxide or chloride of iron. It has been observed that when iron apparatus is employed for generating and conducting the hydrochloric acid gas this conveys along a certain quantity of ferric chloride, from which it cannot be freed before entering the decomposing furnace. Here the iron is deposited either as chloride, or, if the formation of chlorine has already begun, *i.e.*, as soon as watery vapour is mixed with the gases, as pulverulent oxide of iron upon the copper sulphate. This iron dust falls from the vertical drain-pipes through the grating into the space below, whence it is easily removed. It may here, however, be remarked that Deacon, according to private communications, has latterly omitted the partition walls from the decomposition furnace, by which he effects a more ready movement of the gaseous current without any disadvantage. In a Deacon's apparatus, which the author has seen at work in the establishment of Kunheim, at Berlin, the partition walls and the vertical drain-pipes had both been omitted without any detriment being observed in the course of several months' working.

After the mixture has passed through the decomposing furnace it consists of chlorine, water, nitrogen, superfluous oxygen, and unconsumed hydrochloric acid. The latter is condensed in an ordinary condensation apparatus, charged with dilute hydrochloric acid, or water, the temperature of the gases having been previously reduced by air-coolers. The gas is next freed from the accompanying water by passage through a tower filled with chloride of calcium, or, better, through a coke-tower, down which sulphuric acid flows. The gaseous mixture is then fit for absorption in the chloride of lime chambers. As a matter of course a drying apparatus is superfluous if a watery liquid is to be saturated with chlorine, as in the preparation of potassic chlorate.

(To be continued)

* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzenends."

ON SOME AMERICAN VANADIUM MINERALS.

By F. A. GENTH.

I. *Roscoelite.*

I am indebted to Dr. James Blake of San Francisco, California, for a small quantity of the very interesting mineral, which he called "Roscoelite," in honour of Professor Roscoe, whose important investigations have put vanadium in its proper place among the elements.

Roscoelite occurs in small seams, varying in thickness from 1-20th to 1-10th of an inch in a decomposed yellowish, brownish, or greenish rock. These seams are made up of small micaceous scales, sometimes $\frac{1}{4}$ of an inch in length, mostly smaller and frequently arranged in stellate or fan-shaped groups. They show an eminent basal cleavage; soft; the sp. gr. of the purest scales (showing less than 1 per cent of impurities) was found to be 2·938; another specimen of less purity gave 2·921; lustre pearly, inclining to submetallic; colour, dark clove-brown to greenish brown, sometimes dark brownish green.

Before the blowpipe it fuses easily to a black glass, colouring the flame slightly pink. With salt of phosphorus gives a skeleton of silicic acid, a dark yellow bead in the oxidising flame, and and emeral green bead in the reducing flame. Only slightly acted upon by acids, even by boiling concentrated sulphuric acid; but readily decomposed by dilute sulphuric acid, when heated in a sealed tube at a temperature of about 180° C., leaving the silicic acid in the form of white pearly scales, and yielding

a deep bluish green solution. With sodic carbonate it fuses to a white mass. The roscoelite which I received for investigation was so much mixed with other substances, such as gold, quartz, a felspathic mineral, a dark mineral, and very minute quantities of one of orange colour, that it was impossible to select for analysis material of perfect purity. For this reason I have delayed the publication of my results, which were obtained over one year ago, in the hope of being able to repeat my analyses with better and purer specimens; but I now give the results of my analyses because there is no prospect of getting any more of this mineral, as will be seen from a letter of Dr. Blake, dated San Francisco, April 5th, 1876, in which he says, that the mine in which it occurs cannot be worked any farther until a tunnel has been run, and that it is quite uncertain when this will be done.

Although by no means perfect, my results approach the truth and give a fair idea of the composition of the mineral, even if the evident admixture of other minerals, varying in the different samples analysed, from about 1 to perhaps over 12 per cent, does not permit one to calculate the atomic ratio of the constituents and establish the constitution of this species. There is especially an uncertainty with reference to the quantities of silicic acid, alumina, and potassa which belong to the roscoelite, or which may have been introduced by admixtures of felspathic and other minerals, as will appear from the results given below, which show that the mineral, when decomposed with sulphuric or dilute hydrofluoric acid generally gives only about 6 per cent of potassa, while fusion with calcic carbonate and ammonic chloride yields from 8 to 9 per cent. Some of these uncertainties could have been removed, if a larger quantity of the mineral had been at my disposal.

Particular attention was paid to the correct determination of the vanadium and the form in which it exists in the roscoelite.

The separation of vanadium is attended with great difficulties, and I have not found any of the methods of separation to give fully reliable results. This is in part owing to the incomplete precipitation of the vanadic acid, and in part to the impossibility of washing the precipitates completely without loss of vanadium. It was therefore always determined by the only method which I found to give fully reliable results—by titration with potassic permanganate.

After the separation from the other elements, the vanadic acid was reduced by hydrosulphuric acid into V_2O_4, which, after the excess of hydrosulphuric acid had been expelled by continued boiling, was re-oxidised into V_2O_5 by the permanganate. I have satisfied myself by numerous experiments that no matter whether only a very minute quantity of sulphuric acid is present, or a very large excess, the V_2O_4 is completely oxidised into V_2O_5 by this process.

For the determination of the state of oxidation of the vanadium in the roscoelite, a quantity of the mineral was dissolved in dilute sulphuric acid in a sealed tube at a temperature of about 180° C., and was titered after cooling; the liquid was then reduced by hydrosulphuric acid, and after boiling off the excess of the latter it was again titered. From the quantity of oxygen required for oxidation in both cases it was found that vanadium in the mineral is present as $V_6O_{11} = 2V_2O_3, V_2O_5$.

The determinations of the other elements were made by the usual methods.

The finely-powdered mineral was dried (unless otherwise stated) for two days over sulphuric acid, and the different samples gave the following results:—

(*a.*) *Purest Scales.*—The analysis was made by dissolving one portion in sulphuric acid and determining in this the quantity and state of oxidation of the vanadium, the silicic acid, and insoluble impurities. The latter were left behind in dissolving the silicic acid in sodic carbonate and gave 0·85 per cent; a second portion was decomposed by sodic carbonate and nitrate, and a third for the determination of the alkalies by J. L. Smith's method. The V_6O_{11} given below is the mean of the two determinations. (*b.*) Another sample, not quite as pure as *a*, was analysed by fusion. (*c.*) Still more contaminated with impurities, was analysed by dissolving in dilute sulphuric acid in a sealed tube, &c., *cα* is the result of this analysis, *cβ* after deducting 11·45 per cent of the impurities. (*d.*) Another sample was decomposed by dilute hydrofluoric acid; the analysis was unfortunately lost except the determinations given below; the material for this analysis had not been dried over sulphuric acid. (*e.*) This sample was dried over sulphuric acid for several weeks; a portion, which was decomposed by sulphuric acid, gave 5·37 per cent insoluble silicates, 0·23 per cent of gold, and 43·24 per cent of silicic acid; the V_6O_{11} was determined by difference. The results given below were obtained by decomposing the mineral by fusion:—

	a.	*b.*	*cα.*	*cβ.*	*d.*	*e.*
Insol. silicates, quartz, gold, &c.	[0·85]	—	11·45	—	5·91	[5·60]
SiO_2	47·69	47·82	43·46	48·60	—	46·81
Al_2O_3	14·10	12·60	10·52	11·76	—	15·78
FeO	1·67	3·30	2·03	2·27	—	1·58
MgO	2·00	2·43	1·74	1·95	—	2·31
CaO	trace	trace	0·20	0·23	—	trace
Na_2O (trace Li_2O)	0·19	0·33	0·30	0·34	5·96	0·60
K_2O	7·59	8·03	5·35	5·98		8·89
V_6O_{11}	22·02	21·36	20·50	22·92	—	20·16
Ignition	4·96	5·13	5·32	5·95	6·34	3·87
	100·22	101·00	100·87	100·00		100·00

A mineral, very similar in composition, and perhaps a compact impure variety of roscoelite, is found associated with the scales. It has the appearance of a massive dark green chlorite or that of some varieties of serpentine. The analysis was made by fusion, &c., and gave:—

SiO_2	46·09
Al_2O_3	17·46
FeO	1·95
MgO	2·18
Na_2O	0·18
K_2O	8·66
V_6O_{11}	17·53
Ignition	6·37
	100·42

II. *Psittacinite, a New Hydrous Vanadate of Lead and Copper.*

In a paper on "American Tellurium and Bismuth Minerals," read before the American Philosophical Society at the meeting of August 21, 1874 (*Proc. Am. Phil. Soc.*, xiv., 223—231), I mention, on the authority of Mr. P. Knabe, a siskin green pulverulent mineral from the "Iron Rod Mine," Silver Star District, Montana, as a *new* "Tellurate of lead and copper." I had at that time no opportunity to examine into the merits of this mineral, having mislaid the small sample which he had sent me. On receiving a copy of my paper Mr. Knabe furnished me with several specimens, which gave me a sufficient quantity of fair material for an analysis. A qualitative examination proved it to be a hydrous *vanadate* of lead and copper and *not a tellurate*.

When I communicated this result to Mr. Knabe he gave me an interesting account of how he fell into his error. At the Uncle Sam's Lode, in Highland District, occurs with the tetradymite a siskin green mineral, which has not yet been analysed, but which appears to be a tellurate. It looks exactly like the pulverulent variety of the psittacinite from the Iron Rod Mine. When Mr. Knabe dissolved the latter in hydrochloric acid, the evolution of chlorine indicated the presence of a higher oxide; the solution precipitated with an excess of ammonic sulphide gave sulphides of lead and copper and a filtrate, which, on addition of an acid, gave a black pre-

cipitate—vanadic sulphide—which he mistook for tellurous sulphide.

Psittacinite occurs in very thin cryptocrystalline coatings, sometimes showing a small mammillary or botryoidal structure, also peruverlent; colour, siskin green, sometimes with a grayish tint, to olive green. Before the blowpipe it fuses easily to a black shining mass. With fluxes gives the reactions of vanadium, lead and copper. Soluble in dilute nitric acid, the solution yielding on evaporation a deep red mass.

As it was impossible to get any of the mineral in a pure state, I had to use coatings with quartz attached to them, sometimes contaminated with a little limonite; but these admixtures could not influence the analysis farther than very slightly with reference to the amount of water which it contains.

The followin g are my results :—

		a.	*b.*	*c.*	*d.*	*e.*
PbO	..	41·36	50·17	42·89	27·12	42·38
CuO	..	14·34	16·66	14·72	9·75	15·03
V_2O_5	..	14·64	19·05	15·87	9·96	15·77
H_2O	..	7·42	—	not deter.	—	7·25
SiO_2	..	15·13	}	10·10	}	15·57
Al_2O_3	..	1·29	}	3·83	}	}
Fe_2O_3	..	2·72	} 7·60	2·19	} 48·84	} 4·00
MgO	}	not deter.	}	0·63	}	}
CaO	}		}	0·15	}	}

The oxygen ratio of PbO : CuO : V_2O_5 : H_2O in the above analyses is in—

a	..	..	2·97	:	2·89	: 6·41	:	6·59
b	..	..	3·60	:	3·36	: 8·34	:	—
c	..	..	3·08	:	2·97	: 6·95	:	—
d	..	..	1·94	:	1·96	: 4·36	:	—
e	..	..	3·04	:	3·03	: 6·90	:	6·44
or *a*	..	..	1·00	:	0·97	: 2·16	:	2·19
b	..	..	1·00	:	0·93	: 2·31	:	—
c	..	..	1·00	:	0·97	: 2·26	:	—
d	..	..	1·00	:	1·01	: 2·25	:	—
e	..	..	1·00	:	1·00	: 2·27	:	2·12

The average of the five analyses gives the ratio of—

1·00 : 0·98 : 2·25 : 2·15
9·00 : 9·00 : 20·00 : 18·00

corresponding to—

$3(3PbO,V_2O_5)+(3CuO,V_2O_5)+6(CuO,H_2O)+12H_2O$.

giving the following percentage :—

PbO	..	..	..	..	..	53·15
CuO	..	..	..	..	..	18·95
V_2O_5	..	..	..	..	..	19·32
H_2O	..	..	..	..	..	8·58
						100·00

Psittacinite occurs, sometimes associated with gold, and small quantities of cerussite, chalcopyrite, and limonite upon quartz, at several of the mines in Silver Star District, Montana, especially in the Iron Rod Mine and New Career Mine, and its occurrence in these mines is looked upon as a favourable indication, for, when it is met with, the vein becomes immediately, or soon after, rich in gold. This mineral has been called "psittacinite" from psittacinus, siskin or rather parrot green.—*American Journal of Science.*

University of Pennsylvania, Philadelphia,
May 16, 1876.

PSEUDO-SULPHOCYANOGEN (CNSH).

It is well known that when sulphocyanides, more especially the alkaline salts, are treated with chlorine, bromine, or iodine, a yellow body almost entirely insoluble in water is produced. When first obtained this substance was supposed to be the radicle sulphocyanogen, but it was always found on analysis to contain a small and somewhat variable amount of hydrogen, which excess of chlorine will not remove; hence it is termed pseudo-sulphocyanogen.

The action of chlorine, for instance, is not completely represented by the equation—

$$2NH_4SCy+Cl_2=2NH_4Cl+2SCy;$$

some secondary reaction taking place by which hydrogen is introduced.

From some experiments made some time ago to obtain this substance in a pure state or of a definite composition it would appear that the hydrogen is not the only element which varies in its amount in differently prepared specimens.

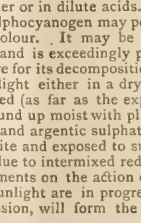
Slight variations in the temperature and strength of the solution of sulphocyanate employed producing comparatively considerable differences in the composition of the product.

When ammonio-sulphocyanate is acted upon by chlorine in excess for some days the filtrate from the yellow precipitate still gives the sulphocyanide reaction with ferric salts, and no chloride of nitrogen has been produced, even when the action of chlorine was continued on the same solution for more than a week. (NH_4Cl+Cl_2 will yield the nitrogen chloride in half an hour.)

NH_4SCy solution absorbs chlorine rapidly with rise of temperature. When the containing vessel is kept cool (10° to 15° C.) and the chlorine not used in excess a light yellow precipitate is produced, which, after washing with hot water, in which it is slightly soluble, appears to undergo a decomposition. It gave, on analysis, the following figures :—

C .. .. 20·53 (mean of two)
H .. .. 1·78 (,, ,,)
S .. .. 53·85 (,, three)
N .. .. (23·40) —

With these figures the formula CNHS agrees sufficiently well, but the tripled formula, $C_3N_3S_3H_3$, seems to agree better with its decomposition by heat product, mellone. The tripled formula is perhaps better written thus :—



A considerable amount of hydrocyanic acid is given off from the substance when suspended in the solution which has been submitted to the action of chlorine. But after washing and drying at 100° C. no HCy is given off when suspended in water or in dilute acids.

The pseudo-sulphocyanogen may possibly be utilised as a water or oil colour. It may be obtained of several shades of yellow and is exceedingly permanent, requiring a high temperature for its decomposition, and is not altered by the action of light either in a dry or moist condition. It is also unaffected (as far as the experiments have continued) when ground up moist with plumbic, bismuth, and argentic nitrates, and argentic sulphate. Mixed wet with solid argentic nitrite and exposed to sunlight a blackening occurs, but only due to intermixed reduced silver.

Further experiments on the action of salts on this substance aided by sunlight are in progress, and the results, with your permission, will form the subject of a future notice.

W. R. H.

Royal College of Chemistry.

ON SOME OF THE CHANGES IN THE PHYSICAL PROPERTIES OF STEEL, PRODUCED BY TEMPERING.

By A. S. KIMBALL,
Prof. of Physics in the Worcester Institute of Industrial Science.

A FEW interesting, and, to a certain extent, novel results, have recently been developed in our laboratory, which I venture to present in their present incomplete form, since the pressure of other duties will postpone, for a few months, further investigations in this direction. Up to the present time the larger number of our experiments have been made upon the behaviour of tempered bars under a transverse stress, although a few qualitative trials have been made upon changes in electric conductivity and coefficients of expansion.

I. *The modulus of elasticity decreases as the hardness of the steel increases; in other words, the harder the bar the greater the deflection produced by a given weight.*

Many manuals of practical mechanics give a higher modulus for tempered than for untempered steel. Reuleaux, in "Der Constructeur" (p. 4), states that it may be increased 50 per cent by hardening. Coulomb and Tredgold state that hardening has no influence whatever, while Styffe finds that the modulus is diminished. For our first experiment, five pieces of good tool-steel, each 13" long, were cut from a half-inch square bar. These were carefully annealed, squared, and polished. No. 1 was laid aside, and the others were hardened in cold water in the usual manner; No 2 was "drawn" on a hot plate to a dark blue; No. 3 to a purple; No. 4 to a straw-colour; No, 5 was left hard. The modulus of elasticity was then determined by measuring the deflection produced by a weight applied at the middle of the bar. The probable error of the experiments did not exceed one-fifth of 1 per cent. The experiment was varied in many ways; several qualities of steel and bars of different dimensions were employed with uniform results. In some grades of steel a difference of more than 10 per cent has been found between the modulus of the hardened and that of the annealed bar.

II. *The increase of deflection in a given time is greater the harder the steel.*

It is well known that the deflection of a bar left under stress will increase for a long time. I am not aware, however, that comparative tests of the rate of increase in steel of different tempers have previously been made.

III. *The immediate set increases with the hardness of the steel.*

In the experiments each bar was of course loaded with the same weight, which was allowed to act for the same number of minutes.

IV. *A bar recovers from a temporary set with greater rapidity the harder it is.*

The remarkable fluctuations in the line of the bar observed by Prof. Norton (*Amer. Journ. of Science and Arts*, April, 1876) became more marked and had a wider range as the hardness of the bar increased. In none of the experiments referred to was a permanent set produced, though in some cases forty-eight hours had elapsed before the bar recovered its original line. In a few experiments an attempt was made to determine the approximate hardness of the bars by grinding. The results obtained, however, could not be considered very reliable. A more satisfactory method was found in the determination of the temperatures employed in hardening and drawing, by the specific heat of platinum, or by the use of the pyrometer.

I am indebted to Mr. F. C. Blake for the accuracy with which the experiments referred to in this note have been conducted.—*American Journal of Science and Arts.*

CORRESPONDENCE.

ON THE PRESENCE OF ARSENIC IN THE VAPOURS OF BONE-MANURE.

To the Editor of the Chemical News.

SIR,—In the CHEMICAL NEWS (vol. xxxiv., p. 68) you criticise a book bearing the above title. In the course of your remarks you say:—"Miasms or organic poisons could scarcely meet with a more efficient corrective than chloride of arsenic, fluorine, and other of the volatile compounds said to be given off. On the other hand, sulphuretted hydrogen and sulphide of ammonium are admirably calculated to purge the atmosphere of arsenical fumes."

I wish, as this opportunity presents itself, to lay before you a fact repeatedly observed, which seems calculated to contradict the suggestion that sulphuretted hydrogen would form a purge for an atmosphere contaminated with arsenical fumes. The same fact would throw some doubt on the other suggestion, viz., that trichloride of arsenic is a corrective for miasms and other organic poisons.

While making some experiments on the purification of hydrochloric acid from arsenic, the late Mr. Henry Deacon suggested to mix the arsenical hydrochloric acid in the gaseous state with gaseous sulphuretted hydrogen. Accordingly, some gaseous hydrogen chloride was mixed with arsentrichloride and sulphuretted hydrogen, in one case in as dry a condition as the use of concentrated sulphuric acid will permit, in another case saturated with aqueous vapour. In the one case, when the gaseous mixture was dry, no trace of sulphide of arsenic had deposited on the side of the glass vessel containing the mixture; in the other case, in which some liquid hydrochloric acid was introduced into the vessel, so that its sides were wet, a little chloride of arsenic had been decomposed and deposited as sulphide. In both instances, however, large quantities of sulphide of arsenic were formed when the gaseous mixture was driven through a wash-bottle containing water.

The experiments were repeated constantly with the same result. The conclusion is that gaseous arsentrichloride does not react upon gaseous sulphuretted hydrogen.

You will readily admit that sulphuretted hydrogen will form no purge for an atmosphere contaminated with arsenical fumes, and you will doubt with me, seeing that chloride of arsenic will not act in the gaseous state upon sulphuretted hydrogen, whether arsentrichloride will, under those conditions, correct the noxious miasms or organic poisons.—I am, &c.,

DR. FERD. HURTER.

Laboratory of Messrs. Gaskell, Deacon, and Co.,
Widnes, August 15, 1876.

PLATINUM COMBUSTION TUBES.

To the Editor of the Chemical News.

SIR,—Your correspondent, writing on the subject of platinum combustion tubes in the CHEMICAL NEWS (vol. xxxiv., p. 67), says:—"With a platinum tube filled with cupric oxide in the manner above described it would be possible to perform a succession of analyses; thus greatly economising time. This arrangement of apparatus is based on purely theoretical considerations. I have had no opportunities of practically testing the value of platinum combustion tubes."

I am happy to be able to supply the practical experience which C. J. H. W. lacks. In a paper on the "Determination of Carbon in Steel," published in the *Journal of the Chemical Society*, for October, 1870, I state that a platinum tube was employed, and that "I was thus saved from the annoyance caused by the fusing or cracking of

glass or porcelain tubes, and was enabled to perform combustion after combustion with the greatest ease."

Before applying the platinum tube to the direct combustion of iron or steel, "an experiment was tried with pure sugar to ascertain whether a stream of oxygen, in conjunction with a layer of only 4 inches of cupric oxide would be sufficient to convert all the carbon into carbonic anhydride. The result was perfectly satisfactory, an amount of carbonic anhydride being obtained equal to 42·086 per cent of carbon instead of 42·105, showing a loss of only 0·019 per cent upon the theoretical amount."

To prove that a platinum tube is equally applicable in the case of small quantities, I give the results of duplicate estimations of carbon in steel by direct combustion :—

1.	2.	3.	4.	5.
1·180	0·921	0·763	0·649	0·359
1·151	0·922	0·759	0·620	0·359
—	—	0·758	—	—

The expense of platinum tubes has probably millitated most against their general use, but where a number of analyses has to be made this would soon be compensated for by the saving of time and glass tubes.—I am, &c.,

W. Douglas Herman.

Cropper's Hill, St. Helens, Lancashire,
August 21, 1876.

THE PRESENCE OF NITRITES IN THE WATER OF THE THAMES.

To the Editor of the Chemical News.

Sir,—The following experiments were made with a view to ascertain whether nitrites of any kind existed in Thames water ; but although the process employed was one capable of detecting the ten-thousandth part of a grain of any nitrite whatever, yet it totally failed in this instance to indicate even a trace. The first experiment was made upon Thames water which had been purposely allowed to concentrate in a steam-boiler until 400 cubic feet of it had been reduced to 8 cubic feet, and of this concentrated water 1 gallon was evaporated down to the bulk of 100 grains, when it was tested in this manner :—One drop of the water in question being placed on a clean white porcelain slab, a corresponding drop of a solution of the protochloride of iron was put close to it, and then the two drops were made to unite by means of a platinum wire, but no visible effect was produced in consequence of the admixture.

The water in this case had been obtained about 1 mile below London Bridge, and a precisely similar negative result was derived from water taken near Vauxhall Bridge, although the amount of concentration was then six times greater than in the first instance ; consequently we cannot regard the existence of nitrites in Thames wate as an established fact : and here, perhaps, it may be as well to remark technically that the nitrites in general, but particularly the nitrite of soda, possesses many advantages over the bisulphite of soda for what is called an "antichlore." It is more easily made, it is cheaper, and after being used it may be recovered by evaporation in the form of nitrate, and again converted into nitrite for repeated use. Moreover, it does not by its employment lead to the production of an acidulously destructive compound like bisulphate of soda, because the nitrite of soda, when used as an antichlore, is merely converted into a neutral nitrate, after having arrested the injurious influence of two atoms of chlorine.

Whilst upon the subject of Thames water, it is interesting to review an observation made by Berzelius, which may be found at page 686 of the fifth volume of his "Chemistry," translated into French by Valerius. After quoting numerous experiments made by Wœhler, Ehrenberg, and Morren, which prove that the effect of infusorial animals in water is to oxidise the water, and generate an air contatning 51 per cent of oxygen and 49 per cent of nitrogen, Berzelius adds—"Il semblerait, d'après cela, que le degagement d'oxygene dans ces animaux est du à traction du soleil sur la chlorophylle qu'ils contiennent," a singularly sagacious conclusion, and one that ought to induce those interested in water-supply to have this matter thoroughly investigated by competent individuals, for it is quite possible that the growing of water-cresses, for instance, and the purification of water are more nearly related to each other than directors of water companies imagine.

That chlorophyll performs important duties in both the vegetable and animal economy seems certain, though its powers as yet are undefined and but little understood. Still, however, we can notice that it invariably exists on the surface of the living leaves of plants, also in the bile, and sometimes in the blood of animals ; and within the last two years it has been discovered that the spots and colouring found upon the eggs of birds is chlorophyll ; and, in some cases, as in the egg of the hedge-sparrow, this chlorophyll is blue (which seems, indeed, to be the colour of pure chlorophyll, as will be explained on a subsequent occasion, when speaking of the composition of bile, a matter now under examination). For the present we may remark that room enough exists to warrant energetic interference on the part of our Metropolitan water directors with the closely-allied subjects of water-purity and water-jobbery ; because it may so be that Nature's remedy is staring them in the face whilst they are blindly hunting by expensive methods to perform a really inexpensive operation, and thus uselessly sinking an immense capital that will have to be paid for hereafter, and therefore in all time to come limit the use of Heaven's greatest boon throughout the largest metropolis in the world. We have already seen something of this kind brought about in the case of coal-gas, the price of which in London at the present moment would not have been more than two shillings per 1000 cubic feet had matters been left to the wholesome action of common sense and honest competition. But all the benefits arising from improvements and economies in gas-making during the last twenty years has been swallowed up by expensive Acts of Parliament and engineering jobbery, so that the price remains almost unchanged, and is, perhaps, unchangeable. —I am, &c.,

Lewis Thompson.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances, de l'Academie des Sciences. No. 4, July 24, 1876.

Observation of the Portion of the Spectrum Below the Red Ray by means of the Effects of Phosphorescence.—M. E. Becquerel.—We may follow by direct vision some of the effects produced in this region of the spectrum. We find thus merely some rather large absorpsion-bands, and to distinguish these it is necessary to have a very intense light. It is probable that many lines and narrower bands may escape this means of observation. The margins of the images are not well defined, except those of the region A'', A''' (the more and the less refrangible parts of the spectral region below the red). On the other hand, the observations do not extend much beyond A''', and do not comprehend all the space where the thermic phenomena are observable. This may depend on the limits within which the effects of phosphorescence are appreciable, and which may not be the same as those of the thermic spectrum. The author's method is to fix a highly phosphorescent substance, such as an alkaline-earthy sulphide, upon paper or glass by means of gum, and

having excited it by the action of diffused light to observe the extinction of phosphorescence produced by this part of the spectrum. This extinction causes unequally active parts to appear, *i.e.*, spaces corresponding to the black rays or bands of the spectrum.

Paraldol, an Isomeric Modification of Aldol.—M. A. Wurtz.—This compound softens at 80°, and is melted at 90°. It dissolves readily in water and alcohol, from which latter it is obtained in fine anorthic prisms.

Reply of M. Hirn to the Criticism of M. Ledieu in "Comptes Rendus," July 10, 1876.—M. Hirn complains that M. Ledieu ascribes to him the very views which he is attempting to refute.

Production of the Electric Effluve.—M. A. Boillot.—The author, in experimenting upon the chemical action of the effluve, makes use of the following arrongement:—Two narrow tubes, filled with graphite in powder and calcined, and are parallel to and near each other. They are inserted with their whole length in a test-tube about 18 centimetres in length, and they terminate each with a platinum wire communicating with the carbon. The wire from one of these tubes traverses the test-tube to its upper part; the other is bent back in a downward direction. Two other tubes enter the test-tube; the one ends at the summit, and the other penetrates to 2 or 3 centimetres of the orifice. The first is destined to introduce the gases, and the second to collect them. The effluve is produced in the space between the two carbon conductors.

Photometric Researches on Coloured Flames.—M. Gouy.—Not suitable for abstraction.

Note on the Radiometer.—M. A. Gaiffe.—The author has made a modification, which he considers proves that the actinic and thermic rays act upon this instrument. It is a radiometer of the ordinary form, the discs being coloured a dead blue on one surface and a dead red on the other. It may be made to revolve in either direction by using alternately suitable sources of heat and light. If, *e.g.*, we expose this instrument to the sunlight, the blue surfaces acquire a predominant action, and after some moments hesitation the mill begins to turn from the left to the right. If it is exposed to the flame of a common gas-jet, or of a Bunsen burner, or to the radiations of a plate of hot iron the rotation takes place in an inverse direction.

Radiometers composed of Laminæ of Different Materials.—MM. Alvergniat Freres.—The following observations have been made with radiometers with discs of different materials. No. 1 is a radiometer with discs of silver and transparent mica. In the light the radiometer turns with the mica in front and the silver repelled; in obscure heat, with the radiometer plunged in water at 30° or 40°, the rotation is in the opposite direction. In ice it turns as if exposed to light. No. 2 is composed of aluminium and blackened mica. In the light this radiometer turns with the metal first, and the blackened surface repelled. Obscure heat and light, however intense, do not modify the direction of the rotation. If plunged in ice it turns in the opposite direction. No 3 is formed of aluminium and mica not blackened. In light this radiometer turns with the mica first. In ice the rotation is in the same direction as in light. Dark heat makes it turn in the opposite direction, with the metal first. With this radiometer M. Jamin made the following experiment:—He directed a small light upon one point of the radiometer while in motion, so as to heat only a single point of the globe. This threw the discs into such a state of equilibrium, that instead of rotation there ensued oscillations like those of a pendulum. The two surfaces of the discs, the metal and the mica, are both repelled: if the distance of the flame is varied one of the two laminæ is repelled more or less. No. 5 is a radiometer with discs of silver and aluminium. This radiometer has been heated to 440°, distilling sulphur, and continuing to make a vacuum with the aid of the mercurial pump. The instrument was rendered insensible, though it turned very quickly if a vacuum was made without heating in the ordinary manner. But if the discs, instead of being made of two metals, were made half of metal and half of mica the instrument could not be rendered insensible. The glass case was pierced by an electric discharge, when the radiometer began to turn with great speed, and continued for an hour. The aperture was so small that its diameter could be approximately estimated only by the aid of a powerful microscope. It was found practicable to re-form a vacuam in this instrument up to 100 m.m., even though perforated; rotation then took place in the ordinary manner. Nos. 6, 7, and 8, are radiometers with discs of mica and varnished copper, green, blue, red, and yellow; the colours, in these conditions, have no effect on the radiation.

Cause of the Motion of the Radometer.—M. G. Salet.—According to all the experiments made, the cause of movement in the various apparatus resembling the radiometer of Crookes is a difference in the temperature of the surfaces of the discs. The theory of Tait appears the best. A disc, compound or simple, whose surfaces have actually two different temperatures, and which is plunged into a highly rarefied atmosphere, begins to move, the hottest surface recoiling. Whilst the difference of temperature exists the movement continues. There is no occasion to bring forward the possible action of gases condensed on the surfaces. Wherever two thermometers, isolated in a vacuum, and constructed of two different substances, A and B, would indicate different temperatures, a radiometer disc composed of adjacent laminæ, the one of the substance A and the other of B, will begin to move, and the movement will show the direction and the degree of the difference of temperature. In the circle of lights the discrepancy between the indications of two thermometers, the one with its bulb blackened maintained itself for an indefinite time; it is the same with the movement of the radiometer. Not content with repeating the experiment of Mr. Crookes and M. Fizeau, by placing the radiometer in the centre of a sphere of opal glass so as to equalise the light and avoid currents of air, the author has made an experiment which he considers absolutely demonstrative. He has fixed upon the mill of a radiometer the needle of a compass: the discs were composed of two laminæ of burnt mica, one of them blackened. Under the influence of an adjacent flame the needle deviated to a certain angle, and variations in the lustre or in the distance of the flame were shown very distinctly by a corresponding change in the deviation. The source of light having remained constant for four days the needle kept its position invariable for the whole of the time. The action of condensed gases cannot be invoked here.

Decomposition of Alkaline Bicarbonates, Moist or Dry, under the Influence of Heat and of a Vacuum.—M. A. Gautier.—Perfectly pure and dry bicarbonate of soda is not sensibly decomposed in a vacuum at 20° to 25°. At 100° it is rapidly decomposed in dry air. Solutions of bicarbonate of soda in water set to evaporate in a vacuum are decomposed at 20° to 25°, and this the more rapidly the greater the quantity of the water. The bicarbonate of potassa is decomposed much less rapidly at elevated temperatures than the corresponding soda salt.

Geological Age of Certain Metallic Veins, and, in particular, of Mercury.—M. Virlet d'Aoust.—The author concludes that in the Asturias, as in Mexico and France, mercury is of very modern origin.

Les Mondes, Revue Hebdomadaire des Sciences, No. 14, August 3, 1876.

Occurrence of the Germs of the Tape-worm in Meat.—An article taken from the *Abeille Medicale* points out the danger of eating meat in the half-raw condition, called by some persons "rare," as the ova of the tape-worm are only killed by thorough cooking. Those whose

tastes lead them to select meat in this condition are recommended to eat the flesh of the horse, which is less infected by the Tænia than the ox, sheep, or pig.

MISCELLANEOUS.

British Pharmaceutical Conference.—(Thirteenth Annual Meeting, Glasgow, 1876. Tuesday, September 5, and Wednesday, September 6).—The following papers are already promised :—

1. "Liquid Extract of Pareira." Mr. Barnard S. Proctor.
2. "Variation in the Strength of the Preparations of Opium." Mr. D. B. Dott.
3. "Report on the Assay of Opium for Morphia." E. L. Cleaver, F.C.S.
4. "Note on the Assay of Opium." Mr. Barnard S. Proctor.
5. "New Derivatives from the Opium Alkaloids." Dr. Wright, F.C.S.
6. "The Presence of Free Acetic Acid in Opium." David Brown, F.C.S.
7. "New Excipients for the Official and other Pill Masses." Mr. G. Welborn.
8. "The Preparation and Preservation of Phosphorus Pills." Mr. T. Haffenden.
9. "Notes on some Salts of Pilocarpine." Mr. A. W. Gerrard.
10. "Report on the Aconite Alkaloids." Dr. Wright, F.C.S.
11. "The Solubility of Cinchona Principles in Glycerine." Mr. T. Andrews.
12. "The Therapeutic Value of the Aloins." Dr. Tilden, F.C.S.
13. "The Active Principle of Capsicum Fruit." J. C. Thresh, F.C.S.
14. "Report of the Oxidation of the Essential Oils." Part IV. C. T. Kingzett, F.C.S.
15. "Report on the Essential Oil of Sage." M. M. P. Muir, F.C.S.
16. "Note on the Benzoates in Suint." Mr. A. Taylor.
17. "Notes on the Colouring Matter of *Crocus Sativus*." W. W. Stoddart, F.C.S.
18. "Pekoe 'Flower'—or, Hair of the Tea Leaf." T. B. Groves, F.C.S.
19. "A New Form of Plaster of Cantharides." Mr. A. W. Gerrard.
20. "A Proposed Solution of Citrate of Iron and Quinine." Mr. J. F. Brown.
21. "Preliminary Report on the Chemistry of Ivy." R. H. Davies, F.C.S.
22. "Supplementary Note on Phosphate Syrups." W. L. Howie, F.C.S.
23. "On Filtering Papers." Thomas Greenish, F.C.S.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

Improvements in the manufacture of alkaline sulphates. J. C. Stevenson, South Shields, Durham. May 8, 1875.—No. 1723. This invention relates to the preparation of common salt to be used in the process patented by Messrs. Hargreaves and Robinson for the manufacture of sulphate of soda by exposing common salt to the action of sulphurous acid.

Improvements in the treatment of natural substances containing phosphates of alumina. M. Prentice, Stowmarket, Suffolk. May 11, 1875.—No. 1758. This invention relates to the treatment of natural products containing phosphoric acid and alumina, and consists in subjecting such natural phosphates to the action of an alkali or alkaline carbonate, such, for example, as caustic soda, or carbonate of soda, or soda-ash, or to what is known as black-ash liquor, or to other alkaline products, such, for example, as the waste alkaline liquors from paper works, in order that the phosphoric acid and the alumina contained in the natural phosphates may be separated therefrom by being thus rendered into a condition capable of being dissolved in water. Or instead of employing any of the before-mentioned alkaline compounds or products, I submit the phosphate of alumina by preference in a finely-divided condition in conjunction with sulphate of soda, coal, or other carbonaceous matter to the action of heat in order that the phosphoric acid, together with the alumina, shall be converted into a soluble condition.

Improvements in dyeing. E. T. Hughes, Chancery Lane, London. (A communication from G. C. F. Bartels and E. F. Freise, Goettingen, Hanover, Germany.) May 11, 1875.—No. 1764. This consists in chemical combination of mercaptane, which has great affinity to both vegetable and animal fibres, whereby instead of using several baths for the different kinds of fibres as heretofore, but one bath is required, and tissues of mixed fibres may be dyed with one bath.

Improvements in the treatment of animal blood, also of fibrous materials, and in the manufacture of manures therefrom. G. F. Snelling, South Terrace, Victoria Road, Upton Lane, Essex. May 19, 1875.—No. 1844. This relates (1) to the treatment of animal blood in special manner. (2) To the treatment of shoddy and woollen and cotton rags in a special manner. (3) To the manufacture of manures from the above ingredients, separately or combined with other ingredients, such manures containing large fertilising properties, which free themselves by or in contact with moisture after application to or upon the soil.

Improvements in the treatment of sewage. M. F. Anderson, Priory Road, Coventry, Warwick. May 19, 1875.—No. 1845. This Provisional Specification describes drying sewage sludge by adding to it coprolite and sulphuric acid.

Improvements in deodorising blood to enable it to be used for manuring and other purposes. J. Smith, Cattle Market, London, Middlesex. May 20, 1875.—No. 1855. This consists in mixing blood with suitable proportions of phosphate of lime or ground coprolites, calcic oxide, and sulphuric acid (or by preference ammonia lignine saturated with sulphuric acid), the mixture being well stirred as the different ingredients are added.

Improvements in and relating to the obtainment of phosphorus and phosphides. J. Townsend, Glasgow, Lanark, N.B. May 21, 1875.—No. 1862. This invention consists in the utilisation, as a source of the phosphorus and phosphides, of phosphate of alumina; and the kind known as Redonda phosphate answers quite well, although other varieties will do so also.

Improvements in photometers. W. Morgan-Brown, Southampton Buildings, London. (A communication from O. Shuette, Rue Gallion, Paris.) May 21, 1875.—No. 1865. This invention consists in measuring light by interposing one or several thicknesses of slightly opaque substances, as paper, carrying increasing numbers, by which figures the relative intensity of the light is measured.

NOTES AND QUERIES.

Analysis of Water of River Hooghly.—Can any of your readers inform me if any analysis of the water of the River Hooghly, in India, has ever been published, and where it may be referred to? I desire to consult such an analysis if possible.—F. J. ROWAN.

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Professors and Lecturers.
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ON A

NEW PROCESS FOR THE QUALITATIVE DETECTION AND THE DETERMINATION OF POTASSA.

By M. A. CARNOT.

In spite of the improvements in the estimation of potassa introduced by Peligot and Schlœsing, its exact determination in a somewhat complex substance remains one of the most delicate operations in analytical chemistry. We have, further, no reagent sensitive enough to detect its presence in small quantities.

The new reaction of the salts of potassa in presence of hyposulphite of soda and a salt of bismuth in a solution mixed with alcohol solves both these difficulties.

We dissolve in a few drops of hydrochloric acid 1 part of the subnitrate of bismuth—say half a grm.—and, on the other hand, about 2 parts (1 grm. to 1½) of crystallised hyposulphite of soda in a few c.c. of water. The second solution is then poured into the first, and concentrated alcohol is added in large excess. This mixture is the reagent.

If brought in contact with a few drops of the solution of a potash-salt it at once gives a yellow precipitate. With an undissolved potassic salt it produces a decidedly yellow colouration, easily recognised.

All potassic salts with mineral acids are equally susceptible of this reaction, sulphates and phosphates as well as nitrates, carbonates, chlorides, &c. It is also very sensitive with the organic salts, tartrates, citrates, &c.

The reaction is not interfered with by the presence of other bases with which nothing analogous is produced. The character is, therefore, perfectly distinct.

Baryta and strontia alone may occasion some difficulty, by reason of the white precipitates of double hyposulphites which they form with the same reagent; but it is very rare to meet them along with potassa, and they are very easily detected and removed.

If we have a solution containing merely a few milligrms. of potassa, it is reduced by evaporation to a very small volume, or even to dryness, when the characteristic reaction readily appears. Or slips of filter-paper may be repeatedly saturated with the dilute solution, and after drying be steeped in the alcoholic reagent, when the yellow colour will appear, especially on the margins of the paper.

The author's quantitative experiments refer chiefly to nitrates, chlorides, and mixtures of the two salts. With some special precautions the method may probably be applied directly to sulphates, though these are easily converted into chlorides by chloride of barium, removing the excess of baryta with sodic or ammonic carbonate.

The hyposulphite of commerce is sufficiently pure for use; the crystals are dissolved in a small quantity of water at the moment of the experiment.

The chloride of bismuth is prepared by treating the pulverised metal with a few drops of nitric acid, evaporating to dryness, and then heating with a very small quantity of hydrochloric acid. The lead possibly present in the bismuth is got rid of by adding to the cold solution concentrated alcohol, which causes chloride of lead to be deposited. Or subnitrate of bismuth may be dissolved in a few drops of hydrochloric acid.

The liquid in which the potassa is to be determined should not exceed 10 to 15 c.c. in bulk, so that the entire volume of the aqueous solutions may not exceed 20 to 25 c.c. For 1 part of supposed potassa we take 2 parts of bismuth or 2½ of subnitrate with 7 parts of crystalline hyposulphite.

The solution of the potassic salt is placed in a small flask, the bismuth solution is added, then the hyposulphite, the whole is mixed rapidly, and 200 to 250 c.c. of concentrated alcohol are added. The whole is agitated for a few moments, and left to settle. The yellow precipitate collects at the bottom of the flask, and may be filtered after a quarter of an hour, and carefully washed with alcohol.

The precipitate cannot be weighed; it is dissolved upon the filter in excess of water; the bismuth is thrown down as sulphide by sulphydrate of ammonia, washed by decantation, collected on a tared filter, dried at 100°, and weighed. The weight obtained may be corrected by separating from the filter a part of the dried precipitate, and heating it again to 150° to 200° in a small platinum crucible, weighing before and after, and correcting the total weight of the sulphide accordingly. The weight of the potassa is found on multiplying the weight of the sulphide of bismuth found by—

$$\frac{3KO}{Bi_2S_3} = 0{\cdot}549$$

The method has been found accurate in presence of soda, lithia, ammonia, lime, magnesia, alumina, and iron. —*Comptes Rendus.*

NOTICE ON THE OIL OF WOOD.

By M. GUIBOURT.

This curious product of India, called by the English *wood-oil* or *Gurjun balsam*, forms already the subject of two papers published in the *Pharmaceutical Journal*, by Messrs. Charles Lowe and Daniel Hanbury. Mr. C. Lowe, who only knew that this resinous liquid is extracted in India, by incisions made in the tree, considers it as a *Copaiva balsam* rendered turbid by a greenish resin held in suspension. The filtered balsam forms a brown and transparent liquid, from which we withdraw by distillation—

Volatile oil	65
Hard resin	34
Water and acetic acid	1

According to Mr. Lowe the volatile oil possesses all the characters of that of copaiva, and the *hard* resin, which he regards as pure *copaivic acid*, free from the *soft* resin, which, according to him, exists in the most part of commercial copaivas, seemed to him to indicate a superior quality as a medicine. I avow that I scarcely understand this conclusion, and that I am so much the less convinced of the identity of the hard resin with copaivic acid as Mr. Lowe has observed in the new resinous balsam the singular property of solidifying when exposed, in a closed vessel, to a temperature of 230° F.; copaiva presents nothing similar. I find further this difference, that the new balsam distilled with an addition of a little quantity of an oxidising body as chlorine, hypochlorite of lime, or bichromate of potash, furnishes an essence of a beautiful blue colour, whilst common copaiva with soft resin scarcely furnishes any coloured essence. The notice concludes with a mention of a falsification which appeared to me at once ill-founded and little to be feared; it is that cold sulphuric acid produces with copaiva a purple colouration like that obtained with cod-liver oil, to such an extent that dishonest persons might sell a mixture of *olive* oil or any other fatty oil with a little quantity of copaiva for cod-liver oil. Mr. D. Hanbury tells us in his notice that oil of wood is extracted from *Dipterocarpus turbinatus* by quite a peculiar process, which I shall describe in a few words, in order to make the nature of the product better known. To obtain it a large incision is made in the trunk of the tree, about 30 inches from the ground, upon

which they kindle and maintain a fire so that the incision may be charred; soon after the liquid begins to run. It is conducted by means of a little gutter, into a vessel destined to receive it. The average yield of the best trees during a season is from 30 gallons, &c. Roxburgh adds that oil of wood is also produced by the *Dipterocarpus incarnus*, *alatus*, and *costatus*. The first is reputed to furnish the best sort and in the largest quantity. Oil of wood, which makes the object of Mr. Hanbury's notice, has been imported in a large quantity from Moulmein, in British Burmah. When filtered it forms a transparent liquid of a very deep brown by transmitted light, but it seems opaque and of an obscure green when seen by reflection. It possesses then in a very marked degree the dichroism observed in all *resinous oils* obtained by fire. I insist on this character, which settles the nature of the *wood-oil*, which is not simply a natural product like copaiva, but which results, in part at least, from a liquid modification of the resin of *Dipterocarpus* obtained by the action of fire. This oil of wood from Moulmein is more consistent than olive oil; it weighs 0·964, and possesses an odour and a taste very analogous to copaiva. It dissolves in twice its own weight of absolute alcohol, with the exception of a little quantity of matter which is separated on standing. But the most curious property of this oil, already noticed by Mr. Lowe and observed anew by Mr. Hanbury, is that it solidifies when heated in a stoppered vial at 266° F.; at this temperature the oil becomes turbid and so gelatinous that it is not displaced by the inversion of the vessel. After cooling the solidification becomes more complete; but a gentle heat aided by a slight agitation re-establishes its former fluidity. Mr. Lowe had indicated the temperature of 230° F. for the solidification of wood-oil. I suppose that the difference of temperature pointed out by the two observers depends on that of the liquids upon which they have operated; for just as the copaiva furnished by various *copahifera* of America, or the turpentines produced by the different species of pines and firs, are not identical, it is very reasonable to think that the *oils of wood* furnished by *Dipterocarpus turbinatus*, *incarnus*, *alatus*, *costatus*, &c., are not absolutely alike; the higher or lower temperature which the oil has undergone may be also a cause of variation in the properties of the product. What I say here is not a supposition; it is a fact at present certain. In the Universal Exhibition of 1855, there were two samples of wood-oil, one coming from *Canara* the other from *Tenasserim*. One of these samples, I do not know which, contained in a little pot of white earthenware which, of an intermediate grade between stoneware and porcelain, had been given by Dr. Royle to M. Delasse, a member of the International Jury, charged to give a report on the bitumens and petroleums admitted to the Exhibition. M. Delasse, not finding there what he sought, sent back the sample, which I judged in consequence ought to be the *new copaiva* announced by Mr. Lowe. It approximates, in fact, much more to the balsam examined by Mr. Lowe than to that for which I am obliged to Mr. Hanbury. The *wood-oil* of Mr. Hanbury has nearly the liquidity of olive oils; if placed between the eye and the sun it is completely transparent and of the colour of dark Malaga wine; by reflection it seems opaque and of an olive green. It behaves with ammonia and magnesia in a very different manner from copaiva. Mixed with liquid ammonia at 22° B., in the proportion by weight of 5 parts of balsam to 2 of alkali, it forms immediately an opaque and very thick mixture which does not change by time. It is not solidified by 1-16th of calcined magnesia; the two substances separate on standing. The wood-oil of M. Delasse has the aspect of a thick and slightly gelatinous liquid. After having deposited a little green resin, which is held in suspension, it becomes almost transparent; if placed between the eye and the sun it is of a very deep red; if seen by reflection it appears still red but turbid, and resembles a liquid in which fine powder of cochineal has been suspended by agitation. The complementary colour of the red does not then appear, but it becomes manifest when, after agitation, a thin layer of the liquid covers the upper side of the bottle. Then in whatever manner we look at this layer there appears a beautiful green colour. The same green colour appears again and becomes permanent when, after having dissolved the wood-oil in alcohol, we leave the liquid to spontaneous evaporation; we then see towards the top of the capsule, between the parts of green resin, white radiating tufts belonging to a particular principle of which I leave the examination to those who have a larger quantity of the material at their disposal. As for the resin it has acquired a permanent green colour, which we find in a dry resin which remains when we boil wood-oil and water for a very long time. This green colour which is also that of the beautiful resin of Piney (*Vateria indica*) which was seen in the Exhibition, establishes a point of comparison between two products which come from trees belonging to the same family, the Dipterocarpeæ; but the resemblance stops there, for the resin of the *Vateria indica* is insoluble in alcohol and very imperfectly soluble in ether, whilst the green resin of the wood-oil is easily soluble in these two mediums. Finally, the wood-oil derived from the Exhibition behaves like copaiva with ammonia and calcined magnesia. It is solidified very promptly with 1-16th of calcined magnesia, and its mixture with ammonia becomes again liquid and tolerably transparent after a momentary opacity. I am far from concluding with Mr. Lowe that the two oleo-resinous bodies are chemically identical; but with regard to their medical uses I think that all the turpentines and balsams, liquids or even solids, can be useful as remedies for the catarrhal state of the mucous membranes. I conclude by saying that the wood-oil of Mr. Hanbury and that derived from the Exhibition have not probably been extracted by the same method. The first has been obtained by the aid of fire, by the process described by Roxburgh; ths second has, without doubt, been obtained without the intervention of this agent, for I do not find the characteristic features of oils which result from the action of fire on resin.—*Journal de Pharmacie et de Chimie.*

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 78.)

Chlorine, Bromine, Iodine, and Fluorine.

By Dr. E. Mylius, of Ludwigshafen.

For the latter purpose Kunheim utilises the chlorine obtained on Deacon's method. The chlorine is here so completely absorbed by the milk of lime through which it passes that mere traces are contained in the air escaping from the exhauster. The draft in the entire apparatus is kept up by any aspiratory arrangement beyond the chloride of lime chambers and measured by an anemometer constructed by Hurter. The latter consists of a U-tube of 5-16ths c.m. internal diameter, with legs about 25 c.m. in length. As one leg of this tube is always in communication with the gaseous current, the pressure occasioned by the current is always shown in the other leg by the tube by the displacement of a liquid therein contained (ether). The U-tube is fixed so that the leg containing the liquid lies flat on a graduated inclined plane, which may be raised or lowered on a frame fitted with a level. The meniscus of the liquid is thus extended diagonally, and the small vertical divisions of the scale are magnified into long horizontal degrees. Kunheim uses a simple upright U-tube filled with ether.

* "Berichte uber die Entwickelung der Chemischen Industrie Während des Letzten Jahrzehends."

The greatest practical difficulty in the Deacon's chlorine process lies in the enormous volume of gas which has to be dealt with, and consequently in the large dimensions required for the chloride of lime chambers. But Deacon has endeavoured to combat these difficulties. He compels the gases to take such a course that they are systematically deprived of chlorine. They meet at first with chloride of lime almost saturated, then, as they lose their chlorine they pass over lime less and less chlorinised till they finally pass out into the atmosphere completely exhausted over fresh hydrate of lime. The arrangements by which this systematic saturation of the lime is produced are of a twofold nature. In the first place chambers are employed in which the lime lies on gratings and which are so connected with each other that the chlorine streams through them successively. As soon as the lime in the chamber nearest the generating apparatus is saturated it is thrown out of connection with the current of chlorine, is charged with fresh lime, and takes its place at the end of the series, whilst a chamber containing lime nearly saturated receives the concentrated portion of the gaseous current. The second kind of methodic saturation is the following, in which is applied the principle of Hasenclever and Helbig's pyrites furnace:—

In a tower are several stories of sloping plates of slate, forming a smaller angle with the perpendicular than the outer surface of the heaped up chloride of lime is capable of taking. In every story the direction of the plates, which are parallel to each other, cuts the plane of the plates, likewise parallel to each other, in the next higher and next lower story. Thus intervals are produced which extend in zigzag from below upwards. At the lower end of each of these intervals is a shovel-wheel by whose revolution the speed of a powder sliding over the plates can be regulated. Into this tower the lime is thrown by means of a hopper and slips from plate to plate till its further fall is stopped by the rollers. But as the falling lime cannot form so acute an angle with the perpendicular as the plates it does not completely fill the interstices, but leaves in every link of the zigzag a wedge-shaped space, through which the gases are compelled to ascend from stage to stage. Hence, as the lime moves constantly downwards in an opposite direction to the current fresh lime enters above, and saturated chloride is taken out below. To obviate incidental stoppages in the motion of the lime there are here and there in the tower openings fitted with valves. This apparatus can scarcely be adopted in practice, as chloride of lime, from its tendency to clog together, moves but slowly down an inclined plane, whence frequent stoppages would be inevitable.

The last mentioned apparatus, suitably modified, is recommended by Deacon for the preparation of salt-cake from diluted chlorine, sulphurous acid, steam, and salt. Instead of lime he causes salt to glide down a tower strongly heated, whilst a mixture of diluted chlorine, sulphurous acid, and steam ascends.

The hydrochloric acid thus formed is condensed and re-converted into chlorine, whilst the sulphuric acid formed by the oxidation of the sulphurous acid converts the salt into sulphate.

(To be continued)

ARAGONITE ON THE SURFACE OF A METEORIC IRON, AND A NEW MINERAL (DAUBREELITE) IN THE CONCRETIONS OF THE INTERIOR OF THE SAME.

By J. LAWRENCE SMITH, Louisville, Ky.

I. *Incrustation of Aragonite.*

The remarks in this communication have reference to some of the masses of iron that have been brought from that region of Mexico called the *Bolson de Mapini*, or the Mexican Desert, situated in Cohahuila and Chihuahua, two of the northern provinces of Mexico; the Deser being 400 miles from east to west, and 500 miles from north to south, bordering on the Rio Grande. This region, so prolific in masses of meteoric iron, has been described by Prof. Burckhardt, of Bonn, as well as by myself.

In 1854 I described three of the masses (*Amer. Journ. of Science and Arts*, vol. xxviii., p. 409): two of these have been brought to the United States, one weighing 125 kilogrms. and the other 630 kilogrms. In 1868 eight others were brought to this country, the heaviest weighing 325 kilogrms. These I described in 1869 (*Amer. Journ. of Science and Arts*, Nov., 1869); and in 1871 I was enabled to give a description and an analysis of a still larger one, weighing about 3500 kilogrms., this last one remaining on the western boundary of the Desert near El Para.

We have some account of one even larger than the last, located in the very centre of the Desert. So far as known there have been found in this locality not less than 15,000 kilogrms. of meteoric matter, an amount exceeding that which has been brought together in cabinets from all other sources.

When I examined the eight masses in 1868, I noticed a white crust on a small part of the surfaces of two of them, but at that time I could not make any critical examination of it. Within the past few months these irons have come under my control, and therefore I have been enabled to examine the points that had been omitted, the most interesting of which forms the subject of this communication.

On one of these masses of iron, weighing 210 kilogrms., there is a small amount of a white incrustation covering about 15 square centimetres of the surface; and on another, weighing 275 kilogrms., there is an incrustation, which covered originally over 200 square centimetres of the surface, attached firmly to the iron, and when broken off (as most of it has been by careless handling of the mass) it brings away with it on the under surface a portion of the iron that has become oxidised: its thickness is from 1 to 5 m.m.

It is quite hard, scratching calc spar very readily; the surface of it is irregular and granular. If broken perpendicularly to the surface of the iron, and ground down, it will receive a very good polish, showing an irregular and wavy structure on many of the pieces, and parallel to the surface of the iron, with yellow and dark brown streaks like the Gibraltar limerock; it effervesces with acids, and is an incrustation of aragonite.

The following is the composition of the mineral:—

Carbonate of lime	93·10
Sesquioxide of iron	1·00
Magnesia	trace
Insoluble residue..	4·60
Water	1·00

As regards its formation, I am satisfied that the crust has been made on the iron since the fall of the latter. Conceiving this to be the case, I desired to know the nature of the rock and soil where these meteorites were found, and I have been able to gather the following particolars from Dr. Butcher, who collected the specimens under examination:—This spot is in an alluvial valley or plain between two ranges of high mountains running parallel with each other, varying in distance from 1 to 3 miles. The mountains at the base are calcareous in formation, and in the hills and plains there are large calcareous deposits. The plain in many places is cut up with deep ravines, and several of the specimens of iron were found among the stones and sand at the bottom of the ravines, and during heavy rains were washed or covered with water. It is, however, only in wet seasons that the water is found remaining in the ravines and depressions of the valley, and this water is always brackish to the taste, containing a large amount of mineral matter.

Without giving any further details of the nature of this region of Mexieo where these meteorites were collected,

sufficient has been stated to show the probable source of the calcareous incrustation which I discovered upon two of them.

This incrustation on meteorites has been discovered but twice before, and in both instances by myself. One of them, however, is of so obscure and unsatisfactory a character that I have not given any public notice of it. The other is the case of the Newton County meteorite described by me (*Amer. Journ. of Science and Arts*, vol. xl., 1865). It is a meteoric stone belonging to the variety classified by M. Daubrée as Syssidères; specimens of it have been furnished by me to the museums of the Garden of Plants, Great Britain and Vienna, with this incrustation in well-defined particles of a translucent character adhering firmly to the surface. The entire amount of this meteorite yet known does not exceed 700 grms., although the primitive mass must still exist in a sparsely settled region of Arkansas, and when obtained will no doubt furnish specimens with a larger amount of the calcareous incrustation upon it.

II. *New Meteoric Mineral, Daubréelite.*

Two of the masses of iron above referred to have been cut across, the section made on one of them being over 15 square decimetres; also several transverse cuts have been made. In all of these sections a number of nodular concretions have been exposed, most of them quite small, and hardly any exceeding a centimetre in diameter. At the first glance all these nodules have the appearance of very finely crystallised troilite; but a little closer inspection reveals the fact that most of these nodules have more or less of a black mineral associated with it. I had never seen anything of the kind before, it being very evident that it was not graphite. As further examination has proved it to be a new and interesting mineral, I have thought proper to designate it after M. Daubrée, who has done so much in the study and elucidation of meteoric minerals.

Daubréelite is a black lustrous mineral, highly crystalline in structure, occurring on the borders of the troilite nodules, and sometimes running across the centre of them, as may be seen in one of the specimens, where, in a nodule of troilite, a vein of the mineral traverses the very centre of the nodule, which is 2 m.m. in width and 12 m.m. long. It has a distinct cleavage, but I cannot make out its crystalline form. It is very fragile, and in the attempt to detach it from the iron it breaks up into small fragments resembling small particles of molybdenite. It is feebly attracted in very fine particles when a strong magnet is brought in contact with it. This may arise from the presence of a minute quantity of troilite, which it is very difficult to get rid of. Pulverised, it furnishes a perfectly black powder, the smallest particle of which gives before the blowpipe a very strong reaction of chromium. Heated very intensely, it loses its brilliant colour and becomes a dull black.

The powdered mineral is dissolved completely in nitric acid. The solution is intensely green, and furnishes a strong reaction of sulphuric acid and oxide of chrome. The other strong acids attack it but slightly.

This solubility in nitric acid readily distinguishes it from chrome iron. The quantity of mineral I was enabled to obtain pure, or nearly so, was very small. the reaction of the acids on the mineral being nearly the same as on troilite. I am enabled to separate them only by varying the strength of the acids, and the length of the time they are in contact with the minerals.

Less than 100 m.grms. were obtained of sufficient purity to make out its composition, and this amount furnished me 36·48 per cent of sulphur; the remainder was chrome, with nearly 10 per cent of iron and a little carbonaceous matter. This mineral, when obtained pure and in sufficient quantity for a thorough analysis (which I hope to make before long), will, I am satisfied, prove to be a protosulphide of chrome; the iron present being mixed with the Daubréelite. The following, therefore, would express its true composition:—Sulphur, 37·62; chrome, 62·38.

This mineral is an interesting one, and is found in a very strange place; yet from what is revealed to us by the spectroscope with regard to the vapours surrounding the sun, the element chrome must be widely diffused in the matter of the universe.—*American Journal of Science and Arts.*

ON DINITRO-PARA-DIBROMBENZOLS AND THEIR DERIVATIVES.

By PETER TOWNSEND AUSTEN.

Two kilogrms. of pure crystallised solid (para) dibrombenzol were divided into portions of 250 grms., and each portion added to a mixture of 800 grms. of fuming nitric acid and an equal volume of concentrated sulphuric acid, and then heated on a sand-bath, when a violent action set in, during which it was found advisable to remove the burners. A reddish yellow oil settled in the bottom of the flask. After boiling three hours the mixture was allowed to cool, and then poured in a thin stream into a large excess of cold water. The oil sank to the bottom and gradually solidified, an operation which may be greatly accelerated by vigorous stirring with a glass rod. The nitrited product from 500 grms. of the dibrombenzol, after the washing out the acid with water, was dissolved in about a kilogramme of glacial acetic acid, filtered, and allowed to stand about seventy hours. A copious separation of the first (α) dinitro-para-dibrombenzol, containing a considerable amount of the second (β) isomer, and but a small amount of the third (γ), took place. By repeated crystallisation, first from carbon disulphide and then from glacial acetic acid, it was obtained perfectly pure. The acetic acid filtrate from the first separation contained the β- and γ-isomers and some of the α. The solution was treated with a large excess of water, and the substances in solution were thus precipitated in the form of a yellow oil, which was then separated from the water by means of a stop-cock funnel, heated on a water-bath until it was entirely dry, dissolved in about 1¼ kilos. of carbon disulphide, and allowed to stand. By standing, a small separation of impure α-isomer generally occurs. The carbon disulphide was then distilled off in portions of 200 c.c., and the respective crystallisations, which consisted of the β-isomer containing a good deal of the α-isomer and traces of the γ, collected. When no more separated the thick oil was heated on a water-bath until the carbon disulphide was entirely volatilised, after which it was exposed to a temperature of 5° for three days, when it became solid. The mass was carefully rubbed in a mortar with ether, at the same temperature, and this ethereal extract (consisting of much γ and little β) separated by a filter-pump. The ether was then evaporated, the oil again exposed to the same temperature, and the operation repeated until the substance dissolved in the ether without leaving a residue. The oil was then exposed to a temperature of about $-8°$ to $-10°$ for nearly two weeks, during which small amounts of the β-isomers crystallised out, and were separated by filtering the oil directly with the filter-pump. Finally no more separated from the oil, which then appeared to contain only an exceedingly small amount of the β-isomer.

Alpha-dinitro-para-dibrombenzol.

The alpha-dinitro-para-dibrombenzol, containing traces of the β-isomer, crystallises from glacial acetic acid in beautiful siriated transparent needles, often attaining a length of 25 c.m. and a diameter of 3 m.m. When perfectly pure, however, it crystallises from the same solvent in short, compact, white, glittering needles, or small prisms. From carbon disulphide it separates in the form of small, hard, white crystals. The compound is inso-

luble in water, easily soluble in boiling absolute alcohol and glacial acetic acid, as well as in benzol and acetic ether. It is slightly volatile in steam. Fuses at 159° to a transparent slightly yellow liquid.

0·3034 grm. substance gave 0·0190 H_2O and 0·2452 CO_2.

0·1749 grm. substance, after the method of Carius, gave 0·1998 AgBr and 0·0027 Ag.

Calculated for $C_6H_3(NO_2)_2Br_2$.	Found. I.	II.
C = 22·08	22·04	—
H = 0·61	0·69	—
Br = 49·08	—	49·74

Nitro-para-dibromaniline.

In a preliminary notice* I mentioned that *a*-dinitro-para-dibrombenzol, by treatment with ammonia, formed a dinitro-bromaniline, which under the influence of amyl-nitrite gave a dinitro-monobrombenzol. By repetition of the experiments, however, with much larger amounts and perfectly pure substances, I find that the reaction is different.

By treating the *a*-dinitro-para-dibrombenzol with strong alcoholic ammonia the crystals take on a light straw-yellow colour. By heating in a closed tube at 100° for three hours the reaction is completed. The red solution obtained was precipitated with water, and the resulting yellow precipitate crystallised from dilute alcohol. The filtrate from the precipitate produced by water gave no trace of bromine with silver nitrate, but starch and potassium iodide proved the presence of a considerable amount of nitrous acid.

By repeated crystallisations from alcohol the substance was obtained pure. It forms orange, yellow, and red needles, which fuse at 75°, and are quite volatile with steam. It is very soluble in most solvents, with the exception of water, in which it dissolves with difficulty.

0·28 grm. substance, third crystallisation, gave 0·0426 H_2O and 0·2536 CO_2.

0·2092 grm. substance, fifth crystallisation, gave, after the method of Carius, 0·2644 grm. AgbBr and 0·0008 Ag.

Calculated for $C_6H_2Br_2(NO_2)_2NH_2$.	Found. I.	II.
C = 24·32	24·69	—
H = 1·01	1·65	—
Br = 54·05	—	54·06

Amyl-nitrite acts at ordinary temperatures on the nitro-para-dibromaniline, and forms, not as I formerly supposed, a dinitro-monobrombenzol, but the ordinary mononitro-para-dibrombenzol. All the properties of the nitro-dibrombenzol (fusing-point 84°) obtained in this manner agreed perfectly with those of the well-known mononitro-para-dibrombenzol.

This, as far as I know, is the first case in which the nitroxyl of a nitro-haloid-benzol is substituted by the amido-group in preference to the haloid atom. In the first series there is, among others, the well-known formation of guanidine from nitro-chloroform by action of ammonia, effected by Hofmann.†

It seemed extremely improbable that aniline could act in a satisfactory manner on the alpha-dinitro-para-dibrombenzol, since the disengaged nitro-group would, without doubt, exert a decomposing influence on the aniline itself as well as on the new compound formed. The dinitro-dibrombenzol was treated with an excess of aniline, and the mixture boiled. A strong reaction, attended with a characteristic deep red colour, occurred. Chlorhydric acid precipitated an oil, and, by stirring, brown flocks were obtained. The product was soluble in alcohol with a deep red colour, but separated from the solution as a slimy mass from which no product susceptible of analysis could be obtained.

By the action of natrium-hydrate solution on the alpha-dinitro-para-dibrombenzol I have obtained a substance forming red salts, which I take to be a nitro-bromphenol, and concerning which I shall, at the earliest opportunity, give full particulars.—*Amer. Journ. of Science and Arts.*

Royal Laboratory of Berlin.

* *Ber. d. Chem. Ges.*, viii., 1183.

† *Ann. Chem. Pharm.*, cxxxix., 107.

NOTICES OF BOOKS.

The Textile Colourist. Edited by C. O'Neill, F.C.S. Vol. I. Manchester: Palmer and Howe.

This is the first half-yearly volume of a monthly paper whose object, as declared in the introductory notice, is "to give an account of what is doing or has been done by practical or scientific men in connection with the dyeing, printing, bleaching, and finishing of textile fabrics and materials." Its editor remarks that "some of the existing journals do give a little space to articles connected with textile colouring," which is certainly not overstating the truth.

Among the most prominent articles we may notice "Critical and Historical Notes upon Turkey Red" taken from the *Moniteur Scientific Quesneville*, manuscripts of Jehan le Begne, a work on dyeing compiled as early as 1431, and giving an interesting account of the tinctorial arts as practised at that time. It proves that a species of calico-printing was in use in London as early as 1410. The translation, executed by Mrs. Merrifield, must have been a task of no small difficulty as the receipts are given in old French with notes in Latin, doubtless of the mediæval type. In one of the receipts quoted we find mention of "Brazil." The red wood then used cannot, of course, have been obtained from South America, but must have been the product of some Asiatic *Cæsalpinia*. There is also a list of British and Irish calico printers in 1840, and a paper on the "Manufacture of Carmine or Extract of Indigo," from *Dingler's Journal*. We regret to see the continental solecism of applying the term "carmine" to preparations of indigo adopted in an English journal, sometimes even without the qualifying word "indigo." The expression "English sulphuric acid" used on the Continent to express ordinary sulphuric acid in contradistinction to the fuming or Nordhausen kind is unusual in England. The term in general use is "oil of vitriol."

We hope that the existence of the "Textile Colourist" may be considered as a proof of a widening and deepening interest in applied science.

A Course of Practical Chemistry Arranged for the Use of Medical Students. By W. Odling, M.B., F.R.S. London: Longmans, Green, and Co.

When a scientific text-book has reached its fifth edition the duties of the critic lie in a very narrow compass. That this manual treats of chemical reactions, chemical manipulation, qualitative analysis, toxicology, and animal chemistry, with especial reference to the requirements of medical students and of the medical profession, is generally known. That it has been found satisfactory by professors of the science may be inferred by the demand for so many editions. The present re-issue, we are told, has been carefully revised, the chapter on general analysis by Dr. John Watts, and those on toxicology and animal chemistry by Dr. T. Stevenson. "In the analytical chapter of this fifth edition, brief, but it is believed for ordinary purposes sufficient, directions are now given for the separation of the several sub-groups of bases from one another, and for the recognition of the several members of these sub-groups in presence of each other."

We cannot, however, approve of the omission of so many of the elements from the plan of the work. It may be argued that as these substances occur neither in medicines nor in articles of food, and are not likely to be employed whether accidentally or maliciously as poisons, a knowledge of their reactions and their detections is of no direct value to the medical man. This is, however, we submit, a somewhat narrow view of the subject. Furthermore, new substances are continually pressed into the service of manufacturing industry and may become the subjects of toxicological inquiry. To take an instance:—Vanadium and its compounds were till lately amongst the rarest of laboratory curiosities. Now they have been introduced into dye and print works and may fall into the hands of those ignorant of their highly poisonous nature. Is not a knowledge of the properties of vanadium and the method of its recognition likely to become of importance to the medical practitioner?

Bulletin of the Bussey Institution. Part V., 1876. Cambridge (U.S.): Wilson and Son.

MOST of our readers are doubtless aware that the Bussey Institution is an establishment connected with the Harvard University, and having for its object the cultivation of chemistry, physics, and biology with reference to agriculture. Its Bulletin is always rich in interesting articles on the composition of soils, manures, and plant-ashes; on the practical effects of manures; on the diseases of cultivated plants and of cattle; and kindred topics of the highest value both to the practical farmer and to all who devote their attention to agricultural chemistry and physiology. The Institution is evidently doing useful work, and we wish it a long and successful career.

Hunyadi János; Aperient Natural Mineral Water. By ALOIS MARTIN, M.D. London: W. Ridgway.

MINERAL waters are evidently in some quarters coming into increased demand, and very persevering efforts are made to bring certain kinds under public notice. The water in question is obtained from certain springs at Buda, and contains 137·9 grs. of sulphate of magnesia, and 128·9 grs. of sulphate of soda per gallon, proportions said to exceed those found in all other known bitter springs. Its physiological action and therapeutic applications are discussed, and it is strongly recommended by high medical authorities in a variety of ailments.

Wine and its Counterfeits. By JAMES L. DENMAN, 20, Piccadilly, London.

WE have here a pamphlet which all wine drinkers should read and remember. The author points out clearly and truthfully the real and unpleasant nature of those concoctions known as port and sherry which were forced upon the nation by an unsound system of duties during the latter part of the 18th and the beginning of the 19th century. The "plastering" process, *i.e.*, the addition of sulphate of lime to the grapes—an operation practised for some mysterious reason upon all sherries—he holds up in its true light as utterly destructive of all real vinous flavour. How any man can drink a liquid containing more than an ounce of an alkaline sulphate per gallon, how he can call the mixture wine and profess he likes it, are to us mysteries inscrutable. Would it not be better to send us the wines pure and allow those consumers who admire the flavour of "Epsoms" or "Glaubers" to add these delicious ingredients to their own liking. While Mr. Denman, however, denounces "plaster," he is no friend to the recently patented deplastering process. It is no doubt possible to ascertain by careful analysis the exact quantity of sulphate of potash present in sherry, and to add tartrate of baryta till all the sulphuric acid is precipitated. But suppose that by some inadvertence a slight excess of baryta remained in the solution! The remedy would be found much worse than the disease. The true method of dealing with plastered and fortified wines is to let them severally alone till Andalusian vine-growers banish gypsum from their premises and give us the pure blood of the grape.

Among the genuine, natural wines now coming into use in England, at least, among those who seek in the glass flavour and not intoxicating power, a high rank belongs to those of Greece. Mr. Denman deserves great credit for his persevering attempts to bring them under the notice of the public. No part of the world is better adapted for the cultivation of the grape than the "Isles of Greece," and the wines imported thence are worthy of their old classic fame.

CORRESPONDENCE.

THE FLAME OF CHLORIDE OF SODIUM IN A COMMON FIRE.

To the Editor of the Chemical News.

SIR,—Some time ago a correspondent of *Nature* (No. 328 Feb. 10, 1876) enquired for an explanation of the fact that while common salt (chloride of sodium) colours the flame of an ordinary spirit-lamp yellow, the same substance thrown upon a common coal fire gives rise to a blue flame. In the next number (329) Dr. Schuster stated that the origin of the blue flame was still involved in mystery, and —if my memory is correct, for I have not the number at hand—that he and Dr. Schorlemmer had been engaged on an investigation of the same.

Dr. Schuster's letter shows that the point is not an unimportant one, and as I have lately made a few experiments which seem to confirm the assumption on which my explanation was based, I beg to solicit space for it in the CHEMICAL NEWS.

The theory I put forward is that the blue flame noticed in the instance of a coal fire (bituminous) on which salt has been thrown is possibly due simply to the presence of *carbonic oxide* (CO), produced by a series of reactions through which the common salt is converted into sulphide of sodium, as in the manufacture of crude carbonate of soda (black-ash); all the reactions being performed in one furnace instead of two, and almost simultaneously.

Leblanc's process consists in—(1) Converting common salt into sulphate of sodium. (2) The "salt cake" resulting is then mixed with coal and limestone, placed in a furnace, and heated strongly, during which part of the process *a blue flame of carbonic oxide is observed to play upon the surface.*

In the case we have under consideration the only difference is that the salt is converted into sulphate of sodium by the oxidation of the iron pyrites, from which no coal is free (and, in fact, it has been proposed to use such a process commercially, viz., by roasting salt with iron pyrites).

At this stage, then, the reaction going on in the fire will be expressed by the equation—

$$4NaCl + 2FeS + O_{11} = 2Na_2SO_4 + Fe_2O_3 + Cl_4.$$

Simultaneously with this the carbon of the coal comes into play, reducing the sulphate to sulphide, with evolution of carbonic oxide—

$$Na_2SO_4 + C_4 = Na_2S + 4CO.$$

Of course were any substance present answering to the limestone used in practice—as might happen in the ash—we should have the full conversion to "black-ash," with further evolution of carbonic oxide—

$$6Na_2S + 8CaCO_3 + C_2 = 6Na_2CO_3 + 6CaS + 2CaO + 4CO.$$

I need not say that carbonic oxide burns with a violet-blue flame, perfectly indistinguishable from that produced by throwing salt into a *bituminous* coal fire. This may be

proved at once by experimenting on a fire of *anthracite*, which itself usually only gives out the lambent blue flame of CO. The presence of salt makes no difference whatever in the colour of this flame, and it is difficult indeed to determine whether the salt is ignited at all. The difference in the two cases is just this:—A bituminous coal fire has usually a large bright or smoky flame: salt thrown on it causes its size and brightness to diminish by robbing it of the free carbon or hydrocarbon*—which gives it those qualities, and which is derived from the volatile matter—as in the reactions stated above, carbonic oxide resulting. But when anthracite is burned free carbon is absent, but carbonic oxide is formed; so that no alteration in colour is discernible. It is possible that the heat, instead of volatilising the sodium compound, and so giving the yellow flame, is entirely occupied in effecting the chemical changes.

With a spirit lamp or a Bunsen burner there is no free carbon, nor is there any iron pyrites to react on the salt, consequently the complicated processes just sketched out cannot go on, and the flame only exhibits the sodium colouration.

Dr. Schuster, in the note above mentioned, referred to a letter published by Dr. Gladstone in the *Phil. Mag.* (vol. xxiv., p. 417), giving a sketch of the similar behaviour of certain chlorides in imparting a blue colour to flames of various kinds. I find that in this paper the violet colour given by the chlorides of sodium, of potassium, and of barium to the flame of red-hot coals is noticed. Dr. Gladstone says, however, that "a doubt must rest on such observations made with a common coal fire, as it is quite conceivable that these chlorides may give up their chlorine to the alkalies or the earths of the ash."

It struck me that it would have some bearing on the matter to ascertain whether other salts of sodium exhibited the same property of tinging the flame blue, and I find that in these is no difference.

A little pure carbonate or sulphate of sodium thrown upon a common coal fire gives exactly the same blue colour as the chloride does; thrown on an anthracite fire they do not alter its bluish flame. Both give the intense yellow flame in the Bunsen burner.

It is clear, therefore, that the blue flame given by common salt cannot be ascribed to a property inherent to chlorides alone, and the solution I have given seems to be the most likely one. Of course the carbonate and the sulphate will give rise to much the same reactions as those stated above.

The following laboratory experiments were made with a view to check the above conclusions:—

(1.) A small porcelain crucible was half filled with common salt, placed in a jacket, and exposed over a Bunsen burner. The flame appearing above the crucible was coloured intensely yellow.

(2.) The same quantity of salt, mixed with powdered charcoal, was placed in the crucible. In this case the flame had hardly any yellow colour, and the edges occasionally appeared blue, the Bunsen flame being able to assert itself. The diminution of the yellow colouration was very marked.

(3.) The crucible was filled with salt and powdered charcoal, together with a little sulphide of iron (the substance used for the preparation of sulphuretted hydrogen), and exposed over the Bunsen burner as before. The yellow colouration was almost entirely absent, while the blue flame became very distinct.

No difference could be observed in these experiments, whether the air was turned on or off.

When these mixtures were exposed in the naked flame on platinum wire they only gave the intense sodium colour. This is doubtless to be ascribed to the stronger heat volatilising same of the salt before it had time to pass through the necessary changes. Moreover, the *slightest trace* of salt in such a mixture gave the yellow colour in the naked flame, while the mixtures used in the crucibles contained fully 15 per cent of salt, so that the supposition as to the effect of difference of temperature seems plausible.

—I am, &c.,

EDWARD T. HARDMAN.
H.M. Geological Survey of Ireland.

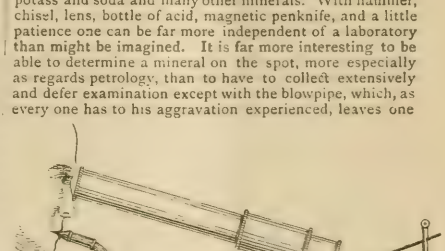
Kilkenny, Aug. 25, 1876.

* Every cook knows that throwing salt on a fire "clears" renders it smokeless.

BLOWPIPE WITH SPECTROSCOPE FOR MINERALOGISTS.

To the Editor of the Chemical News.

SIR,—I enclose a sketch of an upright blowpipe with spectroscope adapted to its little lamp, the whole very portable. My object is discrimination in travelling between potass and soda and many other minerals. With hammer, chisel, lens, bottle of acid, magnetic penknife, and a little patience one can be far more independent of a laboratory than might be imagined. It is far more interesting to be able to determine a mineral on the spot, more especially as regards petrology, than to have to collect extensively and defer examination except with the blowpipe, which, as every one has to his aggravation experienced, leaves one



sadly in the lurch when one gets amongst impure alkalies and alkaline earths. As an instance I have detected both baryta and strontia in arragonite, which blowpipe *solus* failed to show me.—I am, &c.,

MARSHALL HALL.

Scientific Club, August 5, 1876.

CHEMICAL QUESTIONS.

To the Editor of the Chemical News.

SIR,—The manual of Prof. Tilden excels in the intelligent and thoughtful character of the exercises, but I must confess to have failed in the following case, and perhaps some better informed student may help me in the matter:—

I. (No. 35, p. 276.) "The analysis of barium diacetotartrate gave the following results:—

0·2065 grm. gave 0·1297 grm. of $BaSO_4$.
0·1377 grm. gave 0·1307 of CO_2, and 0·0300 of H_2O.

What is the formula of the salt and corresponding acid?" I do not see how this data can furnish the amount of O.

I venture to add some other questions, which cannot well be solved without some approximative grasp of the generic nature of the reactions involved; hence it is that they have more than a mere numerical interest.

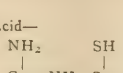
II. M. Grimaux has synthesised the following ureides. What are the types and genetic equations (without further data)?

Di-pyruvic-tri-ureide	=	$C_9H_{12}O_5N_6$
Tetra-pyruvic-tri-ureide		$C_{15}H_{14}O_8N_6$
Di-pyruvic-tetra-ureide		$C_{13}H_{15}O_7N_8$

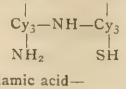
They have been easily resolved, and similarly with the following.

III. What are the types and genetic equations of the following acids?

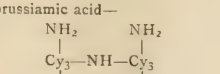
Di-thio-prussiamic acid—



Mono-thio-di-prussiamic acid—



Dithio-tri-prussiamic acid—



—I am, &c.,

S. E. P.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances, de l'Academie des Sciences. No. 5, July 31, 1876.

Fifth Note on Electric Transmissions through the Soil.—M. Th. du Moncel.—Not suitable for abstraction.

Globular Thunderbolts.—M. G. Planté.—The author gives an account of a violent storm at Paris on July 24, between 3.30 and 4 p.m., in which the lightning fell in a globular form upon the house No. 28 of the Rue des Tournelles, and on the corner of the theatre of the Boulevard Beaumarchais. The formation of globular thunderbolts results—(1) From the aggregation in a spherical form of ponderable matter and, in particular, of air and watery vapour, in consequence of the aspiration and the rarefaction which the electric flux determines in its passage; (2) of the condensation of positive electricity in this medium. The electricity is dissipated silently if the soil is strongly negative, otherwise there is an explosion.

Radiometers of Crookes Formed of Laminæ of a Metal and of Mica.—MM. Alvergniat.—As for radiometers partly of metal and partly of mica the authors have not succeeded in rendering them insensible, and still less those of mica alone and blackened. Nevertheless they have a radiometer of plates of metal and of mica blackened, which, when a vacuum had been made in the ordinary manner, turned very readily on approaching a match to the case. On heating very strongly, and continuing to exhaust, it became much less sensitive; the radiation of more than twenty candles placed at 10 centimetres from the globe did not suffice to make it stir, and the full light of the sun was required to set it in motion. But this radiometer, so little sensitive to light, remained highly sensitive to obscure heat. The mere warmth of the hand sufficed to set it in rapid rotation in an inverse direction.

Dissociation of the Vapour of Calomel.—H. Debray.—At 440 calomel experiences incipient decomposition.

Action of Hydracids upon Tellurous Acid.—M. A. Ditte.—An examination of the behaviour of tellurous acid with hydrochloric acid. The author has succeeded in obtaining the compounds $2TeO_2$, $3HCl$, and TeO_2HCl.

New Salts of Bismuth, and their Application in the Detection of Potassa.—M. A. Carnot.—Reserved for insertion in full.

Isomerism of the Rotatory Power in the Camphols.—M. J. de Montgolfier.—The camphols of different origin, natural or artificial, differ among themselves merely by their rotatory power, and we have not at present, in the preparation of this body, even by the same methods, obtained identical results. These various rotations cannot evidently indicate true isomerisms; they may be explained, on the contrary, by mixtures of an active with an inactive body. The author has arrived at the conclusion that borneol may be easily obtained of as high a rotatory power as may be desired up to a limit, which is about 37° for the ray D. This borneol at 37° is the true active body with a complete rotatory power. He has not yet succeeded in obtaining a borneol entirely inactive.

Cause of the Spontaneous Alteration of Anhydrous Hydrocyanic Acid, and on a New Case of the Total Transformation of this Acid.—M. J. de Girard.—It is known that anhydrous cyanic acid sometimes undergoes in a short time the azulmic decomposition, whilst in other cases it may be preserved for months without change. The cause of this difference is due to the chloride of calcium used in desiccation. If this is neutral the acid obtained will be pure, and may be preserved indefinitely; if it is alkaline, which is the case when it has been calcined in contact with the air, the hydrocyanic acid will soon undergo spontaneous decomposition. There is also another cause of the transformation of hydrocyanic acid, not connected with the presence of a trace of alkali, namely, heat. If the pure acid is heated for four to five hours in a sealed tube to 100° it soons turns brown, and finally congeals into a black compact mass. On opening the tubes there is no escape of gas. The acid heated to 100° with anhydrous ether or absolute alcohol experiences a modification which appears analogous.

Decomposition of Cyanide of Potassium, Cyanide of Zinc, and Formiate of Potassa in Carbonic Acid, Air, and Pure Hydrogen.—MM. L. Naudin and F. de Montholon.—Cyanide of potassium is decomposed in inert gases, and the decomposition is only limited by the alkalinity due to the potassa formed. In the case of carbonic acid there is no limit, because the alkali is saturated as it is produced. Cyanide of zinc is slowly decomposed by a rapid current of carbonic acid, and also, though more slightly, by air freed from carbonic acid. Cyanides of uranium and nickel show no trace of decomposition even in a prolonged current of carbonic acid.

Two New Sulphuretted Ureas.—MM. P. de Clermont and E. Wehrlin.—The ureas in question are cresyl-sulphocarbamide, $CS,NH_2NHC_7H_7$, and naphthyl-sulphocarbamide, $CSNH_2NHC_{10}H_7$.

Industrial Use of Vanadium in the Manufacture of Aniline-Black.—M. G. Witz.—After having verified the action of vanadium upon mixed solutions of chlorates and of muriate of aniline, I have found that in dyeing cotton-skeins black the oxidation is considerably hastened in proportion to the concentration of the dye-baths, and, inversely, it becomes the slower as the liquids are more dilute. Having perceived that the reaction begins, not abruptly, but in a manner almost insensible at first, becoming subsequently accelerated, and being completed in a time which varies in the direct ratio of the greater or less quantities of the metal, always very small, which are present, I have profited by these favourable circumstances to apply this mode of the formation of aniline-black to

colours thickened for printing. In certain series of trials I have determined the exceedingly reduced proportion of vanadium which must be employed in the colour to realise the oxidation of the aniline. I have worked very carefully, making impressions with the finger, avoiding all contact with copper or other metals, and with salts as pure as possible. I finally found that in printing one hundred-thousandth of the weight of the aniline salt may be employed. I have printed for some months aniline-blacks in considerable quantity, and have always found a rapidity of oxidation proportional to the amount of the metal employed. It is sufficient to take a quantity of vanadium corresponding to 1-100,000th or 1-200,000th of the weight of muriate of aniline to obtain in a few days, at the temperature of 25° C., a sufficient oxidation. About 1-30,000th may be taken for colours containing 80 grms. of muriate of aniline to the litre of mixed colour. In two or three days at 25° C., and 20 moisture, the colour is perfectly developed. The preparations of sulphuret of copper have been completely abandoned in favour of vanadium, which secures results more prompt and perfect, avoids the deposition of copper on the steel doctors and the corrosion of the engraved cylinders, and, a remarkable thing, the thickened colours may be preserved for several weeks without change. With all these advantages, vanadium only costs the eleventh part of what was formerly paid for copper. All the soluble compounds of vanadium may be used, as the contact with chloric acid brings them to the maximum degree of oxidation. The quantities of vanadium to be added to aniline-blacks vary, in general, inversely as the concentration—that is to say, the proportion of aniline which they contain, as well as the temperature and the length of time set apart for oxidation. The following are the advantages derived from the use of vanadium:—(1) Amelioriation of the richness of the black, and the distinctness of the impression. (2) Suppression of the corrosion of the doctors and cylinders. (3) Facility of regulating the duration of the oxidation at will. (4) Long preservation of the thickened colour. (5) Simpler and more economic preparation.

Manufacture of Dynamite.—M. A. Sobrero.—The author has used the earth of Santa Fiora, in Tuscany, as a substitute for Kieselguhr.

Cellulosic Fermentation Produced by the Aid of Vegetable Organs, and Probable Utilisation of Sugar in Vegetation for the Formation of Cellulose.—M. Durin.—Not adapted for abstraction.

Microzymas of Sprouted Barley and of Sweet Almonds as Producers of Diastase and Synaptase, with reference to a Paper by MM. Pasteur and Joubert.—M. A. Bechamp.—The author defends, his views against the paper of Pasteur and Joubert (*Comptes Rendus*, lxxxiii., p. 5).

Correction in a Communication on Bread-Making in the United States, and on the Properties of the Hop as a Ferment.—M. Sacc.—M. Sacc states that the hop is not a ferment, but merely preserves the yeast from entering into the lactic fermentation.

Note on the Fermentation of Urine, with reference to a Communication by M. Pasteur.—M. H. C. Bastian.

Observations Relative to the Opinions ascribed by Dr. Bastian to Prof. Tyndall.—An extract from two letters from Prof. Tyndall to M. Dumas. (These papers are a contribution to the "burning question" of spontaneous generation.

Metallic Dust in the Atmosphere.—Dr. T. L. Phipson.—The author gives a few cases of the occurrence of metallic dust in the atmosphere in situations where it could not well be derived from artificial sources, and remarks that there certainly exist in the air a great number of substances which ordinary chemical analysis does not indicate.

Bulletin de la Societe Chimique de Paris, No. 2, July 20, 1876.

Remarks on the Real Existence of a Matter formed of Isolated Atoms comparable to Material Points.—M. Berthelot.—With reference to the conclusion of MM. Kundt and Warburg (*Poggendorff's Annalen*, clvii., 356), that the molecule of mercurial gas behaves sensibly as a material point from the point of view of its mechanical and thermic properties, the hypothesis of a monatomic matter in an absolute sense has nothing in common, save the name, with the conceptions of chemists who reason merely on the ponderable ratios of the molecules which are combined or substituted, their atom being defined by its minimum proportionate value. It would require, in my opinion, proofs very different from the speed of sound in a vapour to be admitted. The very notion of an atom indivisible and yet extended and continuous, as well as that of an atom endowed with mass and yet reduced to a material point, seems contradictory in itself.

Thermic Formation of Ozone.—M. Berthelot.—Ozone is a body formed with absorption of heat; it disengages this excess of heat in its oxidations, which explains its superior activity to that of common oxygen. This excess of heat or of energy has been stored up under the influence of electricity; still a remarkable excess, because we have to do with the formation of a body more condensed than that which produces it.

Absorption of Free Pure Nitrogen by Organic Matters at Common Temperatures.—M. Berthelot.—Already noticed.

Reply to certain Critical Objections on Atomicity by M. J. A. le Bel.—M. E. Bourgoin.—If we admit the successive saturation of the elements, as is generally thought in France, and as M. le Bel himself appears to admit, we render illusory all the atomic theory relating to atomicities, as M. Berthelot has judiciously observed. One of the fundamental principles of the atomic theory is that the volume represents the atom, but this principle is implicitly contradicted by experiment: to admit that the atoms of mercury and cadmium represent two volumes, whilst those of phosphorus and arsenic correspond to half a volume, is merely begging the question.

Nitrated Alizarin.—M. A. Rosenstiehl.—Reserved for insertion in full.

Detection of Magenta in Wines.—M. E. Jacquemin.—Already noticed.

Decomposition of Insoluble Carbonates by Sulphuretted Hydrogen.—MM. L. Naudin and F. de Montholon.—Already noticed.

No. 3, August 5, 1876.

Absorption of Free Hydrogen under the Influence of the Effluve.—M. Berthelot.—Hydrogen is absorbed by organic compounds under the influence of the effluve even more rapidly than nitrogen. This has been observed with benzin, terebenthen, acetylen, &c.

New Researches on the Pyrogenous Carbides and on the Composition of Coal-Gas.—M. Berthelot.—A lengthy paper, not suitable for abstraction.

Formation and Decomposition of Binary Compounds by the Electric Effluve.—M. Berthelot.—Ammonia is formed from a mixture of hydrogen and nitrogen. Protoxide of nitrogen is decomposed into free oxygen and nitrogen, and no new oxide of nitrogen is formed. With binoxide of nitrogen a portion of the nitrogen is set free, and protoxide of nitrogen is formed. Sulphuretted hydrogen is decomposed into hydrogen, polysulphide of hydrogen, and free sulphur. The behaviour of seleniuretted hydrogen is similar. Phosphoretted hydrogen is resolved into hydrogen and yellow subphosphuret. The fluorides of boron and silicon, chlorine, and gaseous bromine are not affected. Sulphurous acid is, to a small extent, converted into free oxygen and sulphur insoluble in the bi-

sulphide of carbon. Cyanogen is quickly converted into paracyanogen.

Pyrogeneous Decomposition of Nitrate of Ammonia, and on the Volatility of Ammoniacal Salts.—M. Berthelot.—Not suitable for abstraction.

Reply to the Second Memoir of M. Bourgoin.—M. J. A. Le Bel.—This discussion seems to be in danger of becoming personal.

Decomposition of Alkaline Bicarbonates, Dry and Moist, under the Influence of Heat and of a Vacuum.—M. A. Gautier.—Already noticed.

Alkaline Sulphocarbonates: Criticism on a Product having for its basis Sulphocarbonate of Potassium, and Proposed for the Destruction of the Phylloxera.—M. A. Mermet.—This paper points out the defects of a patent for mixing guano, gypsum, and sulphocarbonate of potassium, and using the resulting compound as a dressing for vines attacked by the phylloxera.]

Decomposition of Cyanide of Potassium, Cyanide of Zinc, and Formiate of Potassa in Carbonic Acid, Air, and Pure Hydrogen.—MM. Naudin and Montholon.—Already noticed.

Two New Sulphuretted Ureas.—MM. Clermont and Wehrlin.—Already noticed.

Note on a Modification introduced into Sugar-Refining.—M. Daniel Klein.—A lengthy paper not suited for abstraction.

The Preparation, the Atomic Weight, and the Determination of Cerium free from Didymium.—M. H. Buhrig.—The atomic weight found is 94·1782. The author proposes to weigh cerium as ceroso-ceric oxide, Ce_3O_4, the composition of which is perfectly constant; the sulphate, oxalate, and hydrate of cerium are transformed into ceroso-ceric oxide at a white-red heat. The author concludes his memoir by an account of some experiments on the influence of certain salts on the sensibility of the reaction of potassic sulphocyanide with ferric chloride. It was known that certain phosphates and fluorides destroy or lessen the intensity of the colouration, but according to the author many other compounds have the same effect, such as free sulphuric acid and the sulphates of Na, K, Mg, and Ce.

Determination of Lithium by means of the Spectroscope.—M. H. Ballmann.—If we dilute progressively a solution of chloride of lithium a point is reached when the ray Li α is no longer visible. According to the author's experiments this limit is fixed for each observer, though liable to individual variations. For the author's eye this limit is 1 m.g. chloride of lithium dissolved in 3345 c.c. If we gradually dilute with water a liquid containing lithic chloride up to the point when a drop evaporated on a platinum wire no longer shows the ray Liα, the solution contains 1 m.g. LiCl in 33·45 c.c. of water, whence the original proportion may be easily calculated according to the quantity added.

Determination of Gold in Pyrites.—M. H. Schwarz.—The author melts 100 grms. pyrites with 46·6 grms. fine iron turnings under a layer of common salt. The monosulphide formed is powdered, and attacked with dilute sulphuric acid in a gas apparatus, the sulphuretted hydrogen being received in ammonia. The matter insoluble in acid is collected, washed, dried, and roasted. It is then mixed with borax and about 2 grms. granulated lead, and the mixture melted in a muffle until the lead collects in a single globule floating in ferruginous scoriæ. This globule is detached, and submitted to cupellation.

Precipitation of Zinc by Sulphuretted Hydrogen in Presence of Bisulphate of Potassium.—M. G. Sulhorst.—Sulphuretted hydrogen partially precipitates zinc from a solution of sulphate of zinc containing bisulphate of potassium, but if the proportion of the latter salt exceeds a certain limit the liquid is no longer rendered turbid. Thus, a solution of 2 grms. sulphate of zinc and 1 grm. bisulphate of potassium gives with sulphuretted hydrogen a precipitate of zinc sulphide containing 19 per cent of the total zinc present in the liquid. If the quantity of bisulphate of potassium is raised to 2 grms. there is no precipitation.—*Zeitschrift für Analytische Chemie.*

Determination of Theine in Tea.—M. H. Schwarz.—Exhaust with boiling acidulated water, neutralise with lime, evaporate to dryness, and exhaust residue with ether. The extract is evaporated to dryness, and the residue weighed as theine.

Determination of Anthracen in Coal-Tar.—M. C. Nicol.—The tar (10 to 20 grms.) is distilled in a small glass retort, luted, and the vapours are directed into a U-tube serving as a receiver, and heated to 200° in a bath of paraffin. The volatile products boiling below 200° are not condensed, whilst anthracen and hydrocarbides, having high boiling-points, collect in the U-tube. A small quantity of the products of distillation remains in the anterior part of the neck of the retort, which is therefore cut off, pounded, and the fragments added to the distillate.. The distillate is then dissolved in glacial acetic acid by the aid of heat, the acid being added in small portions, and it is finally transformed into anthraquinon by means of Luck's process. The temperature should be very high towards the end of the distillation.—*Zeitschrift für Analytische Chemie.*

Les Mondes, Revue Hebdomadaire des Sciences, No. 15, August 10, 1876.

M. Rieffel, of Grandjouan, finds that petroleum is the most satisfactory insectide yet known.

M. Devergie calls attention to the supposed power of the salts of copper for the prevention of cholera.

MISCELLANEOUS.

Mineralogical Society of Great Britain and Ireland—A general meeting of the members of the Mineralogical Society will be held at Glasgow, on Wednesday next, September 6, 1876, after the meeting of the General Committee of the British Association. The exact time and place will be posted up in the British Association Reception Rooms. The chair will be taken by Professor M. Forster Heddle, M.D., F.R.G.S.

University of London.—Examinations for Honours.—*First B.A. and First B.Sc., conjointly.*—Mathematics and Mechanical Philosophy:—1st class. J. E. Aloysius Steggall, First B.A. (Exhibition), Trinity College, Cambridge; Henry Robert Olley, First B.A., Owens College. 2nd class. John Arthur Owen, First B.Sc., private study; Arthur Black, First B.Sc., private study. 3rd class. Walter Plumb Root, First B.A., private study. *First B.Sc. and Preliminary M.B., conjointly.*—Chemistry: 1st class. Ernest H. Cook, First B.Sc., (Exhibition), Royal College of Science, Dublin; Robert Maguire, Prel. Sci., Owens College. 2nd class. William Henry Higgin, First B.Sc., Owens College; Thomas Gough, First B.Sc., private study; James Hugh Paul, First B.Sc. and Prel. Sci., private study; Beaven Neave Rake, Prel. Sci., Guy's Hospital. 3rd class. William Freame, First B.Sc. and Prel. Sci., Royal College of Science, Dublin; Henry Thomas Groom, Prel. Sci., St. Bartholomew's Hospital; Francis Bowe, Prel. Sci., St. Bartholomew's Hospital; James Norie, Prel. Sci., University College. Zoology: 1st class. David Alexander King, Prel. Sci., St. Bartholomew's Hospital. 2nd class. Arthur George Dawson, Prel. Sci., Owens College; Charles Pardey Lukis, Prel. Sci., St. Bartholomew's Hospital; Mark Feetham Sayer, Prel. Sci., University College; William Evans Hoyle, First B.Sc. and Prel. Sci., Owens College and Christ Church, Oxford; Wayland Charles Chaffey, Prel. Sci.

St. Bartholomew's Hospital; Denis McDonnell, Prel. Sci., King's College. 3rd class. Robert Henry Scanes Spicer, Prel. Sci., private study; Robert Maguire, Prel. Sci., Owens College; Henry Thomas Groom, Prel. Sci., St. Bartholomew's Hospital. Experimental Physics: 1st class. H. F. B.A., Morley, First B.Sc. (Arnott Exhibition and Medal), University College. 2nd class. Thomas Bolton, First B.Sc., University College. 3rd class. Julian Stephens, First B.Sc. and Prel. Sci., University College and private study. Botany: 1st class. Joseph Tregelles Fox, Prel. Sci., London Hospital. 2nd class. Anundrao Atmaram, First B.Sc. and Prel. Sci., University College; Robert Henry Scanes Spicer, Prel. Sci., private study; John Mitford Atkinson, Prel. Sci., London Hospital; Andrew William Dallmeyer, First B.Sc. and Prel. Sci., University College; Richard Sisley, Prel. Sci., St. George's Hospital. 3rd class. Charles Pardey Lukis, Prel. Sci., St. Bartholomew's Hospital; Henry Thomas Groom, Prel. Sci., St. Bartholomew's Hospital.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

Improvements in the manufacture of sulphates of soda and potash, and in calcining carbonates of soda and potash. W. Jones and J. Walsh, Middlesbro'-on-Tees, York. May 21, 1875.—No. 1864. According to this Provisional Specification, the charge of chlorides, &c., is put into a flat-bottomed circular metal pan, which forms the bed of a furnace, and on this pan the sulphates are decomposed and calcined until they are finished in one operation. Above the bed are blades for stirring the charge.

Improvements in the treatment of wool, either in the raw or in a manufactured condition. J. Behrens, Bradford, York. (A communication from H. Caro, Mannheim, Germany.) May 21, 1875.—No. 1868. This invention consists in submitting wool, either in the raw or in an unmanufactured or manufactured condition, to the action of chlorine until the shrinking, curling, or felting properties possessed by wool in its natural condition shall have been destroyed or modified.

Improvements in the means or apparatus employed in melting, refining, converting, and puddling iron. W. Middleton, Leeds, York. May 22, 1875.—No. 1881. There is a retort between puddling and heating furnace for receiving cast metal preparatory to its being melted. For refining, a blast is introduced into the retort.

Improved processes for the manufacture of ammoniacal salts, and more particularly the sulphate of ammonia. A. M. Clark, Chancery Lane, Middlesex. (A communication from T. Moerman-Laubuhr, Antwerp, Belgium.) May 22, 1875.—No. 1888. The invention consists in the manufacture of cyanides and alkaline cyanates by means of the nitrogen of the air, and afterwards decomposing their cyanogen in a separate operation, in order to convert the nitrogen into ammonia, which then needs only to be fixed by means of acids and crystallised.

Improvements in the means of and apparatus for the purification of gas. C. Woodall, Vauxhall, and T. Wills, Brixton, Surrey. May 24, 1875.—No. 1891. This invention relates to a method of and apparatus for the better purification of gas from ammonia, carbonic acid, sulphuretted hydrogen, bisulphide of carbon, and their compounds, being accomplished by the injection into certain washers or scrubbers or system of washers or scrubbers, either of the ordinary or some special form of, combined jet or jets of steam and water, or of steam and ammoniacal liquor purified or not, or of sulphide of ammonium specially prepared, or of some other liquid purifying agent, calculated to remove any or all of the above-mentioned compounds. The use of water, purified ammoniacal liquor, or sulphide of ammonium is not new; but the application of these liquids through the intervention of a compound jet or jets, consisting of one tube inserted within another, the outer one being used for the delivery of the liquid and the inner one for the injection of the steam, whereby the gas is subjected to a more effectual washing, is new; as is also the use of crude ammoniacal liquor by means of the said jet or jets for the removal of sulphur compounds from gas which has been previously freed from carbonic acid.

Improvements in the purification of gas, and in the preparation of materials to be used in the said purification. F. C. Hills, Deptford, Kent. May 24, 1875.—No. 1895. This invention consists in separating the sulphuretted hydrogen gas from the carbonic acid gas driven off from gas-liquor while it is being purified by the processes protected by Letters Patent, Nos. 1360, 1868, and 934, 1874, and utilising such sulphuretted hydrogen gas to form sulphide of ammonium, which may be used for purifying gas from bisulphide of carbon. The sulphuretted hydrogen may also be used to form other sulphides, some of which (e.g., sulphide of calcium) are also useful for purifying gas from bisulphide of carbon. Sulphide of ammonium may also be made by passing the sulphuretted hydrogen and carbonic acid gases driven off from the gas-liquor as aforesaid through scrubbers down which gas-liquor is caused to pass.

Improvements in the manufacture of chlorine. H. Deacon, Appleton House, Widnes, Lancaster. May 25, 1875.—No. 1909. The essential feature of this invention consists in the employment for the production of chlorine by what is known as Deacon's process of a mixture of compounds of copper in conjunction with salts or compounds of magnesia, the same being employed either in conjunction with porous substances impregnated with the same, or with magnesite, or with other solid compounds of magnesia, or with compounds of magnesia, or with compounds containing magnesia. Or instead of employing salts or compounds of magnesia in conjunction with salts or compounds of copper, as before referred to, salts of barium, or other elements of like chemical action, may be substituted.

Improvements in the treatment of salt or crude chloride of sodium preparatory to chemical processes, and in apparatus employed in such treatment. R. Milburn and H. Jackson, Pomeroy Street, New Cross Road, Surrey. May 26, 1875.—No. 1917. The inventors form balls of salt by means of a moulding machine. These balls are then dried in a stove, on a travelling apron formed of hinged plates, which hang down when returning to the feeding end.

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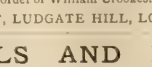

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INAUGURAL ADDRESS OF THE PRESIDENT,

Thomas Andrews, M.D., LL.D., F.R.S., Hon.F.R.S.E., M.R.I.A., &c.

Six and thirty years have passed over since the British Association for the Advancement of Science held its tenth meeting in this ancient city, and twenty-one years have elapsed since it last assembled here. The representatives of two great Scottish families presided on these occasions; and those who had the advantage of hearing the address of the Duke of Argyll in 1855 will recall the gratification they enjoyed while listening to the thoughtful sentiments which reflected a mind of rare cultivation and varied acquirements. On the present occasion I have undertaken, not without anxiety, the duty of filling an office at first accepted by one whom Scotland and the Association would alike have rejoiced to see in this Chair, not only as a tribute to his own scientific services, but also as recognising in him the worthy representative of that long line of able men who have upheld the pre-eminent position attained by the Scottish schools of medicine in the middle of the last century, when the mantle of Boerhaave fell upon Monro and Cullen.

The task of addressing this Association, always a difficult one, is not rendered easier when the meeting is held in a place which presents the rare combination of being at once an ancient seat of learning and a great centre of modern industry. Time will not permit me to refer to the distinguished men who in early days have left here their mark behind them; and I regret it the more, as there is a growing tendency to exaggerate the value of later discoveries, and to underrate the achievements of those who have lived before us. Confining our attention to a period reaching back to little more than a century, it appears that during that time three new sciences arose, at least as far as any science can be said to have a distinct origin, in this city of Glasgow—Experimental Chemistry, Political Economy, and Mechanical Engineering. It is now conceded that Black laid the foundation of modern chemistry; and no one has ever disputed the claims of Adam Smith and of Watt to having not only founded, but largely built up, the two great branches of knowledge with which their names will always be inseparably connected. It was here that Dr. Thomas Thomson established the first school of Practical Chemistry in Great Britain, and that Sir W. Hooker gave to the chair of Botany a European celebrity; it was here that Graham discovered the law of gaseous diffusion and the properties of polybasic acids; it was here that Stenhouse and Anderson, Rankine and J. Thomson made some of their finest discoveries; and it was here that Sir William Thomson conducted his physico-mathematical investigations, and invented those exquisite instruments, valuable alike for ocean telegraphy and for scientific use, which are among the finest trophies of recent science. Nor must the names of Tennant, Mackintosh, Neilson, Walter Crum, Young, and Napier be omitted, who, with many others in this place, have made large and valuable additions to practical science.

The safe return of the "Challenger," after an absence of three and a half years, is a subject of general congratulation. Our knowledge of the varied forms of animal life, and of the remains of animal life, which occur, it is now known, over large tracts of the bed of the ocean, is chiefly derived from the observations made in the "Challenger" and in the previous deep-sea expeditions which were organised by Sir Wyville Thomson and Dr. Carpenter. The physical observations, and especially those on the temperature of the ocean, which were systematically conducted throughout the whole voyage of the "Challenger," have already supplied valuable data for the resolution of the great question of ocean-currents. Upon this question, which has been discussed with singular ability, but under different aspects, by Dr. Carpenter and Mr. Croll, I cannot attempt here to enter; nor will I venture to forestall, by any crude analysis of my own, the narrative which Sir Wyville Thomson has kindly undertaken to give of his own achievements and of those of his staff during their long scientific cruise.

Another expedition, which has more than fulfilled the expectations of the public, is Lieutenant Cameron's remarkable journey across the continent of Africa. It is by such enterprises, happily conceived and ably executed, that we may hope at no distant day to see the Arab slave dealer replaced by the legitimate trader, and the depressed populations of Africa gradually brought within the pale of civilised life.

From the North Polar Expedition no intelligence has been received; nor can we expect for some time to hear whether it has succeeded in the crowning object of Arctic enterprise. In the opinion of many, the results, scientific or other, to be gained by a full survey of the Arctic regions can never be of such value as to justify the risk and cost which must be incurred. But it is not by cold calculations of this kind that great discoveries are made or great enterprises achieved. There is an inward and irrepressible impulse—in individuals called a spirit of adventure, in nations a spirit of enterprise—which impels mankind forward to explore every part of the world we inhabit, however inhospitable or difficult of access; and if the country claiming the foremost place among maritime nations shrink from an undertaking because it is perilous, other countries will not be slow to seize the post of honour. If it be possible for man to reach the poles of the earth, whether north or south, the feat must sooner or later be accomplished; and the country of the successful adventurers will be thereby raised in the scale of nations.

The passage of Venus over the sun's disk is an event which cannot be passed over without notice, although many of the circumstances connected with it have already become historical. It was to observe this rare astronomical phenomenon, on the occasion of its former occurrence in 1769, that Captain Cook's memorable voyage to the Pacific was undertaken, in the course of which he explored the coast of New South Wales, and added that great country to the possessions of the British Crown.

As the transit of Venus gives the most exact method of calculating the distance of the earth from the sun, extensive preparations were made on the last occasion for observing it at selected stations—from Siberia in northern, to Kerguelen's Land in southern latitudes. The great maritime powers vied with each other to turn the opportunity to the best account; and Lord Lindsay had the spirit to equip, at his own expense, the most complete expedition which left the shores of this country. Some of the most valuable stations in southern latitudes were desert islands, rarely free from mist or tempest, and without harbours or shelter of any kind. The landing of the instruments was in many cases attended with great difficulty and even personal risk. Photography lent its aid to record automatically the progress of the transit; and M. Janssen contrived a revolving plate, by means of which from fifty to sixty images of the edge of the sun could be taken at short intervals during the critical periods of the phenomenon.

The observations of M. Janssen at Nagasaki, in Japan,

were of special interest. Looking through a violet-blue glass he saw Venus, two or three minutes before the transit began, having the appearance of a pale round spot near the edge of the sun. Immediately after contact the segment of the planet's disk, as seen on the face of the sun, formed, with what remained of this spot, a complete circle. The pale spot when first seen was, in short, a partial eclipse of the solar corona, which was thus proved beyond dispute to be a luminous atmosphere surrounding the sun. Indications were at the same time obtained of the existence of an atmosphere around Venus.

The mean distance of the earth from the sun was long supposed to have been fixed within a very small limit of error at about 95,000,000 miles. The accuracy of this number had already been called in question on theoretical grounds by Hansen and Leverrier, when Foucault, in 1862, decided the question by an experiment of extraordinary delicacy. Taking advantage of the revolving-mirror, with which Wheatstone had some time before enriched the physical sciences, Foucault succeeded in measuring the absolute velocity of light in space by experiments on a beam of light, reflected backwards and forwards, within a tube little more than thirteen feet in length. Combining the result thus obtained with what is called by astronomers the constant of aberration, Foucault calculated the distance of the earth from the sun, and found it to be one-thirtieth part, or about 3,000,000 miles, less than the commonly received number. This conclusion has lately been confirmed by M. Cornu, from a new determination he has made of the velocity of light according to the method of Fizeau; and in complete accordance with these results are the investigations of Leverrier, founded on a comparison with theory of the observed motions of the sun and of the planets Venus and Mars. It remains to be seen whether the recent observations of the transit of Venus, when reduced, will be sufficiently concordant to fix with even greater precision the true distance of the earth from the sun.

In this brief reference to one of the finest results of modern science, I have mentioned a great name whose loss England has recently had to deplore, and in connection with it the name of an illustrious physicist whose premature death deprived France, a few years ago, of one of her brightest ornaments—Wheatstone and Foucault, ever to be remembered for their marvellous power of eliciting, like Galileo and Newton, from familiar phenomena, the highest truths of nature!

The discovery of Huggins that some of the fixed stars are moving towards and others receding from our system, has been fully confirmed by a careful series of observations lately made by Mr. Christie in the Observatory of Greenwich. Mr. Huggins has not been able to discover any indications of a proper motion in the nebulæ; but this may arise from the motion of translation being less than the method would discover. Few achievements in the history of science are more wonderful than the measurement of the proper motions of the fixed stars, from observing the relative position of two delicate lines of light in the field of the telescope.

The observation of the American astronomer Young, that bright lines, corresponding to the ordinary lines of Fraunhofer reversed, may be seen in the lower strata of the solar atmosphere for a few moments during a total eclipse, has been confirmed by Mr. Stone, on the occasion of the total eclipse of the sun which occurred some time ago in South Africa. In the outer corona, or higher regions of the sun's atmosphere, a single green line only was seen, the same which had been already described by Young.

I can here refer only in general terms to the observations of Roscoe and Schuster on the absorption bands of potassium and sodium, and to the investigations of Lockyer on the absorptive powers of metallic and metalloidal vapours at different temperatures. From the vapour of calcium the latter has obtained two wholly distinct spectra, one belonging to a low, and the other to a high temperature. Mr. Lockyer is also engaged on a new and greatly extended map of the solar spectrum.

Spectrum analysis has lately led to the discovery of a new metal—gallium—the fifth whose presence has been first indicated by that powerful agent. This discovery is due to M. Lecoq de Boisbaudran, already favourably known by a work on the application of the spectroscope to chemical analysis.

Our knowledge of aërolites has of late years been greatly increased; and I cannot occupy a few moments of your time more usefully than by briefly referring to the subject. So recently as 1860 the most remarkable meteoric fall on record, not even excepting that of L'Aigle, occurred near the village of New Concord, in Ohio. On a day when no thunder-clouds were visible, loud sounds were heard resembling claps of thunder, followed by a large fall of meteoric stones, some of which were distinctly seen to strike the earth. One stone, above 50 lbs. in weight, buried itself to the depth of two feet in the ground, and when dug out was found to be still warm. In 1872, another remarkable meteorite, at first seen as a brilliant star with a luminous train, burst near Orvinio, in Italy, and six fragments of it were afterwards collected.

Isolated masses of metallic iron, or rather of an alloy of iron and nickel, similar in composition and properties to the iron usually diffused in meteoric stones, have been found here and there on the surface of the earth, some of large size, as one described by Pallas, which weighed about two-thirds of a ton. Of the meteoric origin of these masses of iron there is little room for doubt, although no record exists of their fall. Sir Edward Sabine, whose life has been devoted with rare fidelity to the pursuit of science, and to whose untiring efforts this Association largely owes the position it now occupies, was the pioneer of the newer discoveries in meteoric science. Eight and fifty years ago he visited, with Captain Ross, the northern shores of Baffin's Bay, and made the interesting discovery that the knife-blades used by the Esquimaux in the vicinity of the Arctic highlands were formed of meteoric iron. This observation was afterwards fully confirmed; and scattered blocks of meteoric iron have been found from time to time around Baffin's Bay. But it was not till 1870 that the meteoric treasures of Baffin's Bay were truly discovered. In that year Nordenskiöld found, at a part of the shore difficult of approach even in moderate weather, enormous blocks of meteoric iron, the largest weighing nearly 20 tons, imbedded in a ridge of basaltic rock. The interest of this observation is greatly enhanced by the circumstance that these masses of meteoric iron, like the basalt with which they are associated, do not belong to the present geological epoch, but must have fallen long before the actual arrangement of land and sea existed—during, in short, the middle Tertiary, or Miocene period of Lyell. The meteoric origin of these iron masses from Ovifak has been called in question by Lawrence Smith; and it is no doubt possible that they may have been raised by upheaval from the interior of the earth. I have indeed myself shown by a magneto-chemical process that metallic iron, in particles so fine that they have never yet been actually seen, is everywhere diffused through the Miocene basalt of Slieve Mish in Antrim, and may likewise be discovered by careful search in almost all igneous and in many metamorphic rocks. These observations have since been verified by Reuss in the case of the Bohemian basalts. But, as regards the native iron of Ovifak, the weight of evidence appears to be in favour of the conclusion, at which M. Daubrée, after a careful discussion of the subject, has arrived—that it is really of meteoric origin. This Ovifak iron is also remarkable from containing a considerable amount of carbon, partly combined with the iron, partly diffused through the metallic mass in a form resembling coke. In connection with this subject, I must refer to the able and exhaustive memoirs of Maskelyne on the Busti and other aërolites, to the discovery of vanadium by R. Apjohn in the meteoric iron, to the interesting observa-

tions of Sorby, and to the researches of Daubrée, Wöhler, Lawrence Smith, Tschermak, and others.

The important services which the Kew Observatory has rendered to meteorology and to solar physics have been fully recognised; and Mr. Gassiot has had the gratification of witnessing the final success of his long and noble efforts to place this observatory upon a permanent footing. A physical observatory for somewhat similar objects, but on a larger scale, is in course of erection, under the guidance of M. Janssen, at Fontenay, in France, and others are springing up or already exist in Germany and Italy. It is earnestly to be hoped that this country will not lag behind in providing physical observatories on a scale worthy of the nation and commensurate with the importance of the object. On this question I cannot do better than refer to the high authority of Dr. Balfour Stewart, and to the views he expressed in his able address last year to the Physical Section.

Weather telegraphy, or the reporting by telegraph the state of the weather at selected stations to a central office, so that notice of the probable approach of storms may be given to the seaports, has become in this country an organised system; and considering the little progress meteorology has made as a science, the results may be considered to be on the whole satisfactory. Of the warnings issued of late years, four out of five were justified by the occurrence of gales or strong winds. Few storms occurred for which no warnings had been given; but unfortunately among these were some of the heaviest gales of the period. The stations from which daily reports are sent to the meteorological office in London embrace the whole coast of Western Europe, including the Shetland Isles. It appears that atmospheric disturbances seldom cross the Atlantic without being greatly altered in character, and that the origin of most of our storms lies eastward of the longitude of Newfoundland.

As regards the velocity of the wind, the cup-anemometer of Dr. Robinson has fully realised the expectations of its discoverer; and the venerable astronomer of Armagh has been engaged during the past summer, with all the ardour of youth, in a course of laborious experiments to determine the constants of his instrument. From seven years' observations at the Observatory of Armagh he has found that the mean velocity of the wind is greatest in the S.S.W. octant and least in the opposite one, and that the amount of wind attains a maximum in January, after which it steadily decreases, with one slight exception, till July, augmenting again till the end of the year.

Passing to the subject of electricity, it is with pleasure that I have to announce the failure of a recent attempt to deprive Oerstedt of his great discovery. It is gratifying thus to find high reputations vindicated, and names which all men love to honour transmitted with undiminished lustre to posterity. At a former meeting of this Association, remarkable for an unusual attendance of distinguished foreigners, the central figure was Oerstedt. On that occasion Sir John Herschel, in glowing language, compared Oerstedt's discovery to the blessed dew of heaven which only the master-mind could draw down, but which it was for others to turn to account and use for the fertilisation of the earth. To Franklin, Volta, Coulomb, Oerstedt, Ampère, Faraday, Seebeck, and Ohm, are due the fundamental discoveries of modern electricity—a science whose applications in Davy's hands led to grander results than alchemist ever dreamed of, and in the hands of others (among whom Wheatstone, Morse, and Thomson occupy the foremost place) to the marvels of the electric telegraph. When we proceed from the actual phenomena of electricity to the molecular conditions upon which those phenomena depend, we are confronted with questions as recondite as any with which the physicist has had to deal, but towards the solution of which the researches of Faraday have contributed the most precious materials. The theory of electrical and magnetic action occupied formerly the powerful minds of Poisson, Green, and Gauss; and among the living it will surely not be invidious to cite the names of Weber, Helmholtz, Thomson, and Clerk Maxwell. The work of the latter on electricity is an original essay worthy in every way of the great reputation and of the clear and far seeing intellect of its author.

Among recent investigations I must refer to Prof. Tait's discovery of consecutive neutral points in certain thermo-electric junctions, for which he was lately awarded the Keith prize. This discovery has been the result of an elaborate investigation of the properties of thermo-electric currents, and is specially interesting in reference to the theory of dynamical electricity. Nor can I omit to mention the very interesting and original experiments of Dr. Kerr on the dielectric state, from which it appears that when electricity of high tension is passed through dielectrics, a change of molecular arrangement occurs, slowly in the case of solids, quickly in the case of liquids, and that the lines of electric force are in some cases lines of compression, in other cases lines of extension.

Of the many discoveries in physical science due to Sir William Grove, the earliest and not the least important is the battery which bears his name, and is to this day the most powerful of all voltaic arrangements; but with a Grove's battery of 50 or even 100 cells in vigorous action, the spark will not pass through an appreciable distance of cold air. By using a very large number of cells, carefully insulated and charged with water, Mr. Gassiot succeeded in obtaining a short spark through air; and lately De la Rue and Müller have constructed a large chloride of silver battery giving freely sparks through cold air, which, when a column of pure water is interposed in the circuit, accurately resemble those of the common electrical machine. The length of the spark increasing nearly as the square of the number of cells, it has been calculated that with 100,000 elements of this battery the discharge should take place through a distance of no less than 8 feet in air.

In the solar beam we have an agent of surpassing power, the investigation of whose properties by Newton forms an epoch in the history of experimental science scarcely less important than the discovery of the law of gravitation in the history of physical astronomy. Three actions characterise the solar beam, or, indeed, more or less that of any luminous body—the heating, the physiological, and the chemical. In the ordinary solar beam we can modify the relative amount of these actions by passing it through different media, and we can thus have luminous rays with little heating or little chemical action. In the case of the moon's rays it required the highest skill on the part of Lord Rosse, even with all the resources of the Observatory of Parsonstown, to investigate their heating properties, and to show that the surface of our satellite facing the earth passes, during every lunation, through a greater range of temperature than the difference between the freezing- and boiling-points of water.

But if, instead of taking an ordinary ray of light, we analyse it as Newton did by the prism, and isolate a very fine line of the spectrum (theoretically a line of infinite tenuity), that is to say, if we take a ray of definite refrangibility, it will be found impossible, by screens or otherwise, to alter its properties. It was his clear perception of the truth of this principle that led Stokes to his great discovery of the cause of epipolic dispersion, in which he showed that many bodies had the power of absorbing dark rays of high refrangibility and of emitting them as luminous rays of lower refrangibility,—of absorbing, in short, darkness, and of emitting it as light. It is not, indeed, an easy matter in all cases to say whether a given effect is due to the action of heat or light; and the question which of these forces is the efficient agent in causing the motion of the tiny disks in Crookes's radiometer has given rise to a good deal of discussion. The answer to this question involves the same principles as those by which the image traced on the daguerreotype plate, or the decomposition of carbonic acid by the leaves of plants, is referred to the action of light and not of heat; and applying these principles to the experiments

made with the radiometer, the weight of evidence appears to be in favour of the view that the repulsion of the blackened surfaces of the disks is due to a thermal reaction occurring in a highly rarefied medium. I have myself had the pleasure of witnessing many of Mr. Crookes's experiments, and I cannot sufficiently express my admiration of the care and skill with which he has pursued this investigation. The remarkable repulsions he has observed in the most perfect vacua hitherto attained are interesting, not only as having led to the construction of a beautiful instrument, but as being likely, when the subject is fully investigated, to give valuable data for the theory of molecular actions.

A singular property of light, discovered a short time ago by Mr. Willoughby Smith, is its power of diminishing the electrical resistance of the element selenium. This property has been ascertained to belong chiefly to the luminous rays on the red side of the spectrum, being nearly absent in the violet or more refrangible rays and also in heat-rays of low refrangibility. The recent experiments of Prof. W. G. Adams have fully established the accuracy of the remarkable observation, first made by Lord Rosse, that the action appeared to vary inversely as the simple distance of the illuminating source.

Switzerland sent, some years ago, as its representative to this country the celebrated De la Rive, whose scientific life formed lately the subject of an eloquent *éloge* from the pen of M. Dumas. On this occasion we have to welcome, in General Menabrea, a distinguished representative both of the kingdom of Italy and of Italian science. His great work on the determination of the pressures and tensions in an elastic system is of too abstruse a character to be discussed in this address; but the principle it contains may be briefly stated in the following words:—"When any elastic system places itself in equilibrium under the action of external forces, the work developed by the internal forces is a minimum." General Menabrea has, however, other and special claims upon us here, as the friend to whom Babbage entrusted the task of making known to the world the principles of his analytical machine—a gigantic conception, the effort to realise which it is known was one of the chief objects of Babbage's later life. The latest development of this conception is to be found in the mechanical integrator of Prof. J. Thomson, in which motion is transmitted, according to a new kinematic principle, from a disk or cone to a cylinder through the intervention of a loose ball, and in Sir W. Thomson's machine for the mechanical integration of differential equations of the second order. In the exquisite tidal machine of the latter we have an instrument by means of which the height of the tide at a given port can be accurately predicted for all times of the day and night.

The attraction-meter of Siemens is an instrument of great delicacy for measuring horizontal attractions, which it is proposed to use for recording the attractive influences of the sun and moon, upon which the tides depend. The bathometer of the same able physicist is another remarkable instrument, in which the constant force of a spring is opposed to the variable pressure of a column of mercury. By an easy observation of the bathometer on shipboard, the depth of the sea may be approximately ascertained without the use of a sounding-line.

The Loan Exhibition of Apparatus at Kensington has been a complete success, and cannot fail to be useful, both in extending a knowledge of scientific subjects and in promoting scientific research throughout the country. Unique in character, but most interesting and instructive, this exhibition will, it is to be hoped, be the precursor of a permanent museum of scientific objects, which, like the present exhibition, shall be a record of old as well as a representation of new inventions.

It is often difficult to draw a distinct line of separation between the physical and chemical sciences; and it is perhaps doubtful whether the division is not really an artificial one. The chemist cannot, indeed, make any large advance without having to deal with physical principles; and it is to Boyle, Dalton, Gay-Lussac, and Graham that we owe the discovery of the mechanical laws which govern the properties of gases and vapours. Some of these laws have of late been made the subject of searching inquiry, which has fully confirmed their accuracy, when the body under examination approaches to what has not inaptly been designated the ideal gaseous state. But when gases are examined under varied conditions of pressure and temperature, it is found that these laws are only particular cases of more general laws, and that the laws of the gaseous state, as it exists in nature, although they may be enunciated in a precise and definite form, are very different from the simple expressions which apply to the ideal condition. The new laws become in their turn inapplicable when from the gaseous state proper we pass to those intermediate conditions which, it has been shown, link with unbroken continuity the gaseous and liquid states. As we approach the liquid state, or even when we reach it, the problem becomes more complicated; but its solution even in these cases will, it may confidently be expected, yield to the powerful means of investigation we now possess.

Among the more important researches made of late in physical chemistry, I may mention those of F. Weber on the specific heat of carbon and the allied elements, of Berthelot on thermo-chemistry, of Bunsen on spectrum analysis, of Wüllner on the band- and line-spectra of the gases, and of Guthrie on the cryohydrates.

Cosmical chemistry is a science of yesterday, and yet it already abounds in facts of the highest interest. Hydrogen, which, if the absolute zero of the physicist does not bar the way, we may hope yet to see in the metallic form, appears to be everywhere present in the universe. It exists in enormous quantity in the solar atmosphere, and it has been discovered in the atmospheres of the fixed stars. It is present, and is the only known element of whose presence we are certain, in those vast sheets of ignited gas of which the nebulæ proper are composed. Nitrogen is also widely diffused among the stellar bodies, and carbon has been discovered in more than one of the comets. On the other hand, a prominent line in the spectrum of the Aurora Borealis has not been identified with that of any known element; and the question may be asked—Does a new element, in a highly rarefied state, exist in the upper regions of our atmosphere? or are we, with Ångström, to attribute this line to a fluorescent or phosphorescent light produced by the electrical discharge to which the aurora is due? This question awaits further observations before it can be definitely settled, as does also that of the source of the remarkable green line which is everywhere conspicuous in the solar corona.

I must here pause for a moment to pay a passing tribute to the memory of Ångström, whose great work on the solar spectrum will always remain as one of the finest monuments of the science of our period. The influence, indeed, which the labours of Ångström and of Kirchhoff have exerted on the most interesting portion of later physics can scarcely be exaggerated; and it may be truly said that there are few men whose loss will be longer felt or more deeply deplored than that of the illustrious astronomer of Upsala.

I cannot pursue this subject further, nor refer to the other terrestrial elements which are present in the solar and stellar atmospheres. Among the many elements that make up the ordinary aërolite, not one has been discovered which does not occur upon this earth. On the whole we arrive at the grand conclusion that this mighty universe is chiefly built up of the same materials as the globe we inhabit.

In the application of science to the useful purposes of life, chemistry and mechanics have run an honourable race. It was in the valley of the Clyde that the chief industry of this country received, within the memory of many here present, an extraordinary impulse from the

application by Neilson of the hot blast to the smelting of iron. The Bessemer steel process and the regenerative furnace of Siemens are later applications of high scientific principles to the same industry. But there is ample work yet to be done. The fuel consumed in the manufacture of iron, as, indeed, in every furnace where coal is used, is greatly in excess of what theory indicates; and the clouds of smoke which darken the atmosphere of our manufacturing towns, and even of whole districts of country, are a clear indication of the waste, but only of a small portion of the waste, arising from imperfect combustion. The depressing effect of this atmosphere upon the working population can scarcely be overrated. Their pale- I had almost said etiolated—faces are a sure indication of the absence of the vivifying influence of the solar rays, so essential to the maintenance of vigorous health. The chemist can furnish a simple test of this state of the atmosphere in the absence of ozone, the active form of oxygen, from the air of our large towns. At some future day the efforts of science to isolate, by a cheap and available process, the oxygen of the air for industrial purposes may be rewarded with success. The effect of such a discovery would be to reduce the consumption of fuel to a fractional part of its present amount; and although the carbonic acid would remain, the smoke and carbonic oxide would disappear. But an abundant supply of pure oxygen is not now within our reach; and in the meantime may I venture to suggest that in many localities the waste products of the furnace might be carried off to a distance from the busy human hive by a few horizontal flues of large dimensions, terminating in lofty chimneys on a hill-side or distant plain? A system of this kind has long been employed at the mercurial mines of Idria, and in other smelting-works where noxious vapours are disengaged. With a little care in the arrangements the smoke would be wholly deposited, as flue-dust or soot, in the horizontal galleries, and would be available for the use of the agriculturist.

The future historian of organic chemistry will have to record a succession of beneficent triumphs, in which the efforts of science have led to results of the highest value to the wellbeing of man. The discovery of quinine has probably saved more human life, with the exception of that of vaccination, than any discovery of any age; and he who succeeds in devising an artificial method of preparing it will be truly a benefactor of the race. Not the least valuable, as it has been one of the most successful, of the works of our Government in India, has been the planting of the cinchona tree on the slopes of the Himalaya. As artificial methods are discovered, one by one, of preparing the proximate principles of the useful dyes, a temporary derangement of industry occurs, but in the end the waste materials of our manufactures set free large portions of the soil for the production of human food.

The ravages of insects have ever been the terror of the agriculturist, and the injury they inflict is often incalculable. An enemy of this class, carried over from America, threatened lately with ruin some of the finest vine districts in the South of France. The occasion has called forth a chemist of high renown; and in a classical memoir recently published, M. Dumas appears to have resolved the difficult problem. His method, although immediately applied to the *Phylloxera* of the vine, is a general one, and will no doubt be found serviceable in other cases. In the apterous state the *Phylloxera* attacks the roots of the plant, and the most efficacious method hitherto known of destroying it has been to inundate the vineyard. After a long and patient investigation, M. Dumas has discovered that the sulpho-carbonate of potassium, in dilute solution, fulfils every condition required from an insecticide, destroying the insect without injuring the plant. The process requires time and patience; but the trials in the vineyard have fully confirmed the experiments of the laboratory.

The application of artificial cold to practical purposes is rapidly extending; and, with the improvement of the ice-machine, the influence of this agent upon our supply of animal food from distant countries will undoubtedly be immense. The ice-machine is already employed in paraffin works and in large breweries; and the curing or salting of meat is now largely conducted in vast chambers, maintained throughout the summer at a constant temperature by a thick covering of ice.

I have now completed this brief review, rendered difficult by the abundance, not by the lack of materials. Even confining our attention to the few branches of science upon which I have ventured to touch, and omitting altogether the whole range of pure chemistry, it is with regret that I find myself constrained to make only a simple reference to the important work of Cayley on the Mathematical Theory of Isomers, and to elaborate memoirs which have recently appeared in Germany on the reflection of heat- and light-rays, and on the specific heat and conducting power of gases for heat, by Knoblauch, E. Wiedemann, Winkelmann, and Buff.

The decline of science in England formed the theme, fifty years ago, of an elaborate essay by Babbage; but the brilliant discoveries of Faraday soon after wiped off the reproach. I will not venture to say that the alarm which has lately arisen, here and elsewhere, on the same subject will prove to be equally groundless. The duration of every great outburst of human activity, whether in art, in literature, or in science, has always been short, and experimental science has made gigantic advances during the last three centuries. The evidence of any great failure is not, however, very manifest, at least in the physical sciences. The journal of Poggendorff, which has long been a faithful record of the progress of physical research throughout the world, shows no signs of flagging; and the *Jubelband* by which Germany celebrated the fiftieth year of Poggendorff's invaluable services was at the same time an ovation to a scientific veteran, who has perhaps done more than any man living to encourage the highest forms of research, and a proof that in Northern Europe the physical sciences continue to be ably and actively cultivated. If in chemistry the case is somewhat weaker, the explanation, at least in this country, is chiefly to be found in the demand on the part of the public for professional aid from many of our ablest chemists.

But whatever view be taken of the actual condition of scientific research, there can be no doubt that it is both the duty and the interest of the country to encourage a pursuit so ennobling in itself, and fraught with such important consequences to the wellbeing of the community. Nor is there any question in which this Association, whose special aim is the advancement of science, can take a deeper interest. The public mind has also been awakened to its importance, and is prepared to aid in carrying out any proposal which offers a reasonable prospect of advantage.

In its recent phase the question of scientific research has been mixed up with contemplated changes in the great universities of England, and particularly in the University of Oxford. The national interests involved on all sides are immense, and a false step once taken may be irretrievable. It is with diffidence that I now refer to the subject, even after having given to it the most anxious and careful consideration.

As regards the higher mathematics, their cultivation has hitherto been chiefly confined to the Universities of Cambridge and Dublin, and two great mathematical schools will probably be sufficient for the kingdom. The case of the physical and natural sciences is different, and they ought to be cultivated in the largest and widest sense at every complete university. Nor, in applying this remark to the English universities, must we forget that if Cambridge was the *Alma Mater* of Newton and Cavendish, Oxford gave birth to the Royal Society. The ancient renown of Oxford will surely not suffer, while her material position cannot fail to be strengthened, by the expansion of scientific studies and the encouragement of scientific research within her walls. Nor ought such a proposal to

be regarded as in any way hostile to the literary studies, and especially to the ancient classical studies, which have always been so carefully cherished at Oxford. If, indeed, there were any such risk, few would hesitate to exclaim — Let science shift elsewhere for herself, and let literature and philosophy find shelter in Oxford! But there is no ground for any such anxiety. Literature and science, philosophy and art, when properly cultivated, far from opposing, will mutually aid one another. There will be ample room for all, and, by judicious arrangements, all may receive the attention they deserve.

A University, or Studium Generale, ought to embrace in its arrangements the whole circle of studies which involve the material interests of society, as well as those which cultivate intellectual refinement. The industries of the country should look to the Universities for the development of the principles of applied as well as of abstract science; and in this respect no institutions have ever had so grand a possession within easy reach as have the universities of England at this conjuncture, if only they have the courage to seize it. With their historic reputation, their collegiate endowments, their commanding influence, Oxford and Cambridge should continue to be all that they now are; but they should, moreover, attract to their lecture halls and working cabinets students in large numbers preparing for the higher industrial pursuits of the country. The great physical laboratory in Cambridge, founded and equipped by the noble representative of the House of Cavendish, has in this respect a peculiar significance, and is an important step in the direction I have indicated. But a small number only of those for whom this temple of science is designed are now to be found in Cambridge. It remains for the University to perform its part, and to widen its portals so that the nation at large may reap the advantage of this well-timed foundation.

If the Universities, in accordance with the spirit of their statutes, or at least of ancient usage, would demand from the candidates for some of the higher degrees proof of original powers of investigation, they would give an important stimulus to the cultivation of science. The example of many Continental Universities, and among others of the venerable University of Leyden, may here be mentioned. Two proof essays recently written for the degree of Doctor of Science in Leyden, one by Van der Waals, the other by Lorenz, are works of unusual merit; and another pupil of Professor Rijke is now engaged in an elaborate experimental research as a qualification for the same degree.

The endowment of a body of scientific men devoted exclusively to original research, without the duty of teaching or other occupation, has of late been strongly advocated in this country; and M. Fremy has given the weight of his high authority to a somewhat similar proposal for the encouragement of research in France. I will not attempt to discuss the subject as a national question, the more so as after having given the proposal the most careful consideration in my power, and turned it round on every side, I have failed to discover how it could be worked so as to secure the end in view.

But whatever may be said in favour of the endowment of pure research as a national question, the Universities ought surely never to be asked to give their aid to a measure which would separate the higher intellects of the country from the flower of its youth. It is only through the influence of original minds that any great or enduring impression can be produced on the hopeful student. Without original power, and the habit of exercising it, you may have an able instructor, but you cannot have a great teacher. No man can be expected to train others in habits of observation and thought he has never acquired himself. In every age of the world the great schools of learning have, as in Athens of old, gathered around great and original minds, and never more conspicuously than in the modern schools of chemistry, which reflected the genius of Liebig, Wöhler, Bunsen, and Hofmann. These schools have been nurseries of original research as well as models of scientific teaching; and students attracted to them from all countries became enthusiastically devoted to science, while they learned its methods from example even more than from precept. Will anyone have the courage to assert that organic chemistry, with its many applications to the uses of mankind, would have made in a few short years the marvellous strides it has done if Science, now as in mediæval times, had pursued her work in strict seclusion,—

> Semota ab nostris rebus, seiunctaque longe,
> Ipsa sui pulchra opibus, nil indiga nostri?

But while the Universities ought not to apply their resources in support of a measure which would render their teaching ineffective, and would at the same time dry up the springs of intellectual growth, they ought to admit freely to university positions men of high repute from other universities, and even without academic qualifications. An honorary degree does not necessarily imply a university education; but it if have any meaning at all, it implies that he who has obtained it is at least on a level with the ordinary graduate, and should be eligible to university positions of the highest trust.

Not less important would it be for the encouragement of learning throughout the country that the English Universities, remembering that they were founded for the same objects, and derive their authority from a common source, should be prepared to recognise the ancient Universities of Scotland as freely as they have always recognised the Elizabethan University of Dublin. Such a measure would invigorate the whole university system of the country more than any other I can think of. It would lead to the strengthening of the literary element in the northern, and of the practical element in the southern universities, and it would bring the highest teaching of the country everywhere more fully into harmony with the requirements of the times in which we live. As an indirect result, it could not fail to give a powerful impulse to literary pursuits as well as to scientific investigations. Professors would be promoted from smaller positions in one university to higher positions in another, after they had given proofs of industry and ability; and stagnation, hurtful alike to professorial and professional life, would be effectually prevented. If this union were established among the old universities, and if at the same time a new university (as I myself ten years ago earnestly proposed) were founded on sound principles amidst the great populations of Lancashire and Yorkshire, the university system of the country would gradually receive a large and useful extension, and, without losing any of its present valuable characteristics, would become more intimately related than hitherto with those great industries upon which mainly depend the strength and wealth of the nation.

It may perhaps appear to many a paradoxical assertion to maintain that the industries of the country should look to the calm and serene regions of Oxford and Cambridge for help in the troublous times of which we have now a sharp and severe note of warning. But I have not spoken on light grounds, nor without due consideration. If Great Britain is to retain the commanding position she has so long occupied in skilled manufacture, the easy ways which (owing partly to the high qualities of her people, partly to the advantages of her insular position and mineral wealth) have sufficed for the past will not be found to suffice for the future. The highest training which can be brought to bear on practical science will be imperatively required; and it will be a fatal policy if that training is to be sought for in foreign lands because it cannot be obtained at home. The country which depends unduly on the stranger for the education of its skilled men, or neglects in its highest places this primary duty, may expect to find the demand for such skill gradually to pass away, and along with it the industry for which it was wanted. I do not claim for scientific education more than it will accomplish, nor can it ever replace the after-training of the workshop or factory. Rare and powerful minds have, it is true, often been independent of it; but high education

always gives an enormous advantage to the country where it prevails. Let no one suppose I am now referring to elementary instruction, and much less to the active work which is going on everywhere around us, in preparing for examinations of all kinds. These things are all very useful in their way, but it is not by them alone that the practical arts are to be sustained in the country. It is by education in its highest sense, based on a broad scientific foundation, and leading to the application of science to practical purposes—in itself one of the noblest pursuits of the human mind—that this result is to be reached. That education of this kind can be most effectively given in a university, or in an institution like the Polytechnic School of Zürich, which differs from the scientific side of a university only in name, and to a large extent supplements the teaching of an actual university, I am firmly convinced; and for this reason, among others, I have always deemed the establishment in this country of Examining Boards with the power of granting degrees, but with none of the higher and more important functions of a university, to have been a measure of questionable utility. It is to Oxford and Cambridge, widely extended as they can readily be, that the country should chiefly look for the development of practical science; they have abundant resources for the task, and if they wish to secure and strengthen their lofty position, they can do it in no way so effectually as by showing that in a green old age they preserve the vigour and elasticity of youth.

If any are disposed to think that I have been carrying this meeting into dream-land, let them pause and listen to the result of similar efforts to those I have been advocating, undertaken by a neighbouring country when on the verge of ruin, and steadily pursued by the same country in the climax of its prosperity. "The University of Berlin," to use the words of Hofmann, "like her sister of Bonn, is a creation of our century. It was founded in the year 1810, at a period when the pressure of foreign domination weighed almost insupportably on Prussia; and it will ever remain significant of the direction of the German mind that the great men of that time should have hoped to develop, by high intellectual training, the forces necessary for the regeneration of their country." It is not for me, especially in this place, to dwell upon the great strides which Northern Germany has made of late years in some of the largest branches of industry, and particularly in those which give a free scope for the application of scientific skill. "Let us not suppose," says M. Wurtz in his recent Report on the Artificial Dyes, "that the distance is so great between theory and its industrial applications. This report would have been written in vain, if it had not brought clearly into view the immense influence of pure science upon the progress of industry. If unfortunately the sacred flame of science should burn dimly or be extinguished, the practical arts would soon fall into rapid decay. The outlay which is incurred by any country for the promotion of science and of high instruction will yield a certain return; and Germany has not had long to wait for the ingathering of the fruits of her far-sighted policy. Thirty or forty years ago industry could scarcely be said to exist there; it is now widely spread and successful." As an illustration of the truth of these remarks I may refer to the newest of European industries, but one which in a short space of time has obtained considerable magnitude. It appears (and I make the statement on the authority of M. Wurtz) that the artificial dyes produced last year in Germany exceeded in value those of all the rest of Europe, including England and France. Yet Germany has no special advantage for this manufacture except the training of her practical chemists. We are not, it is true, to attach undue importance to a single case; but the rapid growth of other and larger industries points in the same direction, and will, I trust, secure some consideration for the suggestions I have ventured to make.

The intimate relations which exist between abstract science and its applications to the uses of life have always been kept steadily in view by this Association, and the valuable Reports, which are a monument to the industry and zeal of its members, embrace every part of the domain of science. It is with the greater confidence, therefore, that I have ventured to suggest from this Chair that no partition-wall should anywhere be raised up between pure and applied science. The same sentiment animates our vigorous ally, the French Association for the Advancement of Science, which rivalling, as it already does, this Association in the high scientific character of its proceedings, bids fair in a few years to call forth the same interest in science and its results, throughout the great provincial towns of France, which the British Association may justly claim to have already effected in this country. No better proof can be given of the wide base upon which the French Association rests than the fact that it was presided over last year by an able representative of commerce and industry, and this year by one who has long held an exalted position in the world of science, and has now the rare distinction of representing in her historic Academies the literature as well as the science of France.

Whatever be the result of our efforts to advance science and industry, it requires no gift of prophecy to declare that the boundless resources which the supreme Author and Upholder of the Universe has provided for the use of man will, as time rolls on, be more and more fully applied to the improvement of the physical—and, through the improvement of the physical, to the elevation of the moral—condition of the human family. Unless, however, the history of the future of our race be wholly at variance with the history of the past, the progress of mankind will be marked by alternate periods of activity and repose; nor will it be the work of any one nation or of any one race. To the erection of the edifice of civilised life, as it now exists, all the higher races of the world have contributed; and if the balance were accurately struck, the claims of Asia for her portion of the work would be immense, and those of Northern Africa not insignificant. Steam-power has of late years produced greater changes than probably ever occurred before in so short a time. But the resources of Nature are not confined to steam, nor to the combustion of coal. The steady water-wheel and the rapid turbine are more perfect machines than the stationary steam-engine; and glacier-fed rivers with natural reservoirs, if fully turned to account, would supply an unlimited and nearly constant source of power depending solely for its continuance upon solar heat. But no immediate dislocation of industry is to be feared, although the turbine is already at work on the Rhine and the Rhone. In the struggle to maintain their high position in science and its applications, the countrymen of Newton and Watt will have no ground for alarm so long as they hold fast to their old traditions, and remember that the greatest nations have fallen when they relaxed in those habits of intelligent and steady industry upon which all permanent success depends.

At the conclusion of the Address the Duke of Argyll said—I rise for the purpose of asking you to record a vote of earnest and hearty thanks to our distinguished President for the most able and instructive Address which he has just delivered. The President has modestly called a great part of his Address a brief review of the recent triumphs of science. No one knows better than our distinguished President the utter impossibility, within the short space to which a presidential address is necessarily confined, of giving an adequate idea of the immense activities of modern science. But those who look carefully over this review, slight as the sketch may be held to be, will see that it is a sketch drawn by a master hand. It gave us a few points, but they are the salient points of recent discovery; they were told in close connection with each other, and above all they were told in that most valuable of all connections in relation to our duty as members of the

British Association—in the connection between that which has been already done and that which it still remains to do. There was one very remarkable passage of our President's Address—I do not know whether it has attracted your attention as much as it attracted mine—in which he referred, lightly indeed, but significantly, to a notion that there is at present a danger of decline in the scientific activities of England, and, he added, that the periods of great intellectual activity in the human mind are almost always short. This may be true, and I am inclined to think that if the remark is applied to literature it is true, but my own impression is that as applied to science it is not true. We are at the present moment living in a golden age of scientific inquiry. As regards literature, it was only last week that I had the opportunity of conversing on the subject with a most distinguished man, who perhaps among many others was most able to appreciate the matter of which he spoke, and he gave it as his impression that as regards literature and philosophy there was a marked decline in eminence and ability, and certainly if we compare the state of literature now with the burst of genius which illustrated the close of last century and the first twenty-five years of the present we may be inclined to come to that conclusion, for where is the galaxy that will compare with Burns, Scott, Wordsworth, Southey, and Campbell? But when we come to science I rejoice to think that the contrast is remarkable indeed. Let me just remind this great assembly of the names of the living, and the men who have lately left us. In geology we have names—the grave has only just closed over them—the names of Murchison and Sedgwick, of a Lyell and Phillips; and I need hardly say that in those we have a group of names in whose powerful hands a branch of inquiry which but a few years ago was a ridicule and a discredit has risen to be one of the most popular and most certain sciences which illustrate the progress of the human mind. Then, again, physics. It is not very long ago that we had Faraday, and I rejoice to say we have still yourself, Mr. President. Again, in natural history we have Darwin and Walton, and even those who may not accept—and I am one of those who do not accept—the special theory of Mr. Darwin as a satisfactory explanation of the deepest mystery of nature,—namely, the history of creation. Even those who do not accept that theory must admit that Mr. Darwin stands A1 among the naturalists of the world. So, also, in comparative anatomy. On this platform, in all these departments of science we have assembled to-night men whom I do not name because they are present, and because they are personal friends of many of us, but whose names will be a household word in every home of science during generations which are yet unborn. Therefore, I repeat, we have no reason to fear any decline in intellectual activity so far as the discoveries and progress of science are concerned; and this brings me to another observation of the President's, to which I confess I attach special value. I thank you for the wise and weighty words which you have spoken upon the vexed question of the endowment of research. I sometimes wonder if those who call for the endowment of research have ever thought what real scientific research is. You may pay and pension men for the mere collecting and assorting of dry facts, but you cannot command by your pensions or emoluments that fire of genius, that intuition of the mind, which is the secret of all true and real scientific research. I should deeply deplore to see the day when scientific research was to depend for its appointments and the selection of its favourites upon any Minister or any Government. There is, indeed, another department of the endowment of research in which I think it may take a powerful and useful part, and I cannot illustrate that department better than by referring to the fitting out of th: "Challenger" Expedition. You all know that my hon. friend and former colleague, Mr. Robert Lowe, was considered one of the hardest-fisted Chancellors of the Exchequer who ever filled the office, but he has a highly educated mind. He knows as well as any man the things which private enterprise should be expected to undertake and what individual means cannot accomplish, and therefore he at once assented to the sending out of that great expedition, which, I believe, will be found to have added immensely to our knowledge of the secrets of nature. There is only one other observation in your Address, Mr. President, to which I would direct the attention of this meeting before I move the resolution of thanks, and it was that passage in which you spoke of there being no wall of partition between abstract and applied sciences—do not let us ever quit hold of the ground that the true spirit of science is to be found in the love of knowledge for its own sake. Applications are sure to follow applications infinitely greater in number and amount than any human imagination could conceive beforehand; but we pursue science for its own sake, thankful and grateful for the benefits to mankind which it scatters around with so lavish a hand. And let me say, Mr. President, you might have added, let there be no wall of partition between science strictly so-called and speculative philosophy. I am sure you will be inclined to agree with me when I say that one of the dangers of our modern science, arising from its very vitality and spirit and energy and growth, is the tendency to let speculation outrun knowledge. But the remedy for this is not to bar the way against abstract speculation of any kind, not to forbid or ostracise it in our halls of science, but rather to encourage it, and to remind scientific men, to remind ourselves, and to remind the world that after all our discoveries how very little our knowledge is; and where science has discovered this she will recognise her proper sphere, and philosophy will be chastened and subdued. The noble Duke concluded by moving the thanks of the Association to their distinguished President for his admirable Address.

The motion was seconded by Sir Wm. Thomson, and was carried by acclamation.

ADDRESS TO THE CHEMICAL SECTION

BY

WILLIAM HENRY PERKIN, F.R.S.,
President of the Section.

There can be no doubt that chemistry and the allied sciences are now being recognised to a much greater extent in this country than in former years; and not only so, the workers at research, though still small in number, are more numerous than they were.

In 1868 Dr. Frankland, in his Address to this Section at the Meeting at Norwich, commented upon the small amount of original research then being carried on in the United Kingdom; but, judging from the statistics of the Chemical Society, this state of things became even worse, for in 1868 there were forty-eight papers read before the Society, but in 1872 only twenty-two. Since then, however, there has been a considerable increase in the number; and at the Anniversary Meeting in March last it was shown that the number of communications for the Session had risen to sixty-six, or three times as many as in 1872.

Of course these figures only refer to the Chemical Society, but I think they may be taken as a very safe criterion of the improved state of things, though it would be very gratifying to see much greater activity.

It is also very pleasing to find that the aids to and opportunities for research are increasing, because it must be remembered that, in a pecuniary sense, science is far from being its own rewarder at the time its truths are being studied, although the results very often become eventually of the greatest practical value; hence the wisdom of a country encouraging scientific research.

But little, however, has been done in this direction in past years—the grants made for general science by this Association, and that of the Government of one thousand pounds annually to the Royal Society, being the most important.

The Chemical Society has also been in the habit of giving small grants for the purpose of assisting those engaged in chemical research. In the future, however, it will be able to do much more than hitherto. One of the original members of the Society, Dr. Longstaff, offered in the early part of the year to give one thousand pounds provided a similar sum could be raised, the united amount to be invested and the interest applied for the encouragement of research. I am happy to say that rather more than the required sum has been raised, and it is hoped that it may be still further supplemented.

In addition to the Royal Society grant, the Government have given this year a further annual sum of four thousand pounds. Of course this is for science generally.

Mr. T. J. Phillips Jodrell has also placed at the disposal of the Royal Society the munificent sum of six thousand pounds, to be applied in any manner that they may consider for the time being most conducive to the encouragement of research in physical sciences.

When we consider how much of our science is of a physical nature we must be grateful for this bequest; and it is to be hoped that these helps will more and more stimulate research in the United Kingdom; and if we have any hope of keeping pace with the large amount of work now being carried on in other countries, we must indeed be energetic.

The employment of well-trained chemists in chemical works is now becoming much more general than heretofore, especially on the Continent, where in some cases a considerable staff is employed and provided with suitable appliances, for the purpose not only of attending to and perfecting the ordinary operations which are in use, but to make investigations in relation to the class of manufacture they are engaged in. A conviction of the necessity of this is gaining strength in this country, though not so quickly as might be desired; nevertheless these things are encouraging.

With reference to the progress of chemistry and what have been the fruits of research of late years, it will be impossible for me to give even a general outline, the amount of work being so large; in fact, to recount the list of investigations made during the past year would take up most of the time at my disposal.

Amongst the most interesting, perhaps, are those relating to isomerism, especially in the aromatic series of organic bodies; and it is probable that a more intimate knowledge of this subject will be found of really practical value.

As I am unable to give an account of the work done during the past year on account of its extent and diversity, I propose to refer to some of the practical results which have already accrued from Organic Chemistry, as a plea for the encouragement of research; and those I intend to speak of are of special interest also on account of their close connection with the textile manufactures of Great Britain. I need scarcely say I refer to the colouring-matters which have been obtained from the products found in tar.

It was in 1856, now twenty years since, that this industry was commenced by the discovery of the "mauve" or "aniline purple;" and it may be of interest to state that it was in Scotland, in the autumn of the same year, that the first experiments upon the application of this dye to the arts of dyeing and calico-printing were made, at Perth and Maryhill.

I need scarcely remind you of the wonderful development of this industry since then, seeing we now have from the same source colouring-matters capable of producing not only all the colours of the rainbow, but their combinations. I wish, however, to briefly refer to the date and origin of the products which have served to build up this great industry.

It was in 1825 that Faraday published, in the *Philosophical Transactions*, his research on the oily products separated in compressing oil-gas, and described a substance he obtained from it—a volatile colourless oil, which he called Bicarburetted Hydrogen. Mitscherlich some years afterwards obtained the same substance from benzoic acid, and gave it the name it bears, viz., "Benzol." This same chemist further obtained from benzol, nitrobenzol, by acting upon it with nitric acid. Zinin afterwards studied the action of reducing agents upon nitrobenzol, and obtained "aniline," which he at that time called Benzidam.

Again, Pelletier and Walter discovered the hydrocarbon toluol in 1837. Deville produced its nitro-compound in 1841; and Hofmann and Muspratt obtained from this "toluidine," by the process used by Zinin to reduce nitrobenzol.

I might mention other names in connection with these substances, such as Runge and Unverdorben; but I would now ask, Did any of these chemists make these investigations with the hope of gain? was it not rather from the love of research, and that alone? and now these products, which were then practically useless, are the basis of the aniline colours. But to go further: Doebereiner a long while ago obtained from alcohol a substance which he called "light oxygen ether," now known as aldehyd. Gay-Lussac produced iodide of ethyl in 1815. Dumas and Peligot discovered the corresponding substance iodide of methyl in 1835; but, as in the cases I have previously referred to, these bodies had no practical value, and were never prepared but in the laboratory. Hofmann, in his researches on the molecular constitution of the volatile organic bases, discovered in 1850 the replacement compounds of aniline containing alcohol radicals.

All these compounds have now been manufactured on the large scale, and used in the futher development of the industry of these artificial colouring-matters.

Other substances might be mentioned; but I think these are sufficient to show how the products of research which, when first discovered and for a long period afterwards, were of only scientific interest, at last became of great practical value; and it is evident that, had not the investigations and discoveries I have referred to been made as they were solely from a love of science, no aniline colours would now be known.

The colouring-matters I have hitherto spoken of are nitrogenous, and derived from benzol and its homologues. There are a few others, however, of the same origin which contain no nitrogen; but they are of secondary importance.

I now pass on to another class of colouring-matter, which is obtained from anthracen, a coal-tar product differing from benzol and toluol in physical characters, inasmuch as it is a magnificent crystalline solid.

The first colouring-matter derived from anthracen which I wish to draw your attention to, is alizarin, the principal dyeing agent found in madder-root. This substance was for a long time supposed to be related to naphthalin, inasmuch as phthalic acid can be produced from both of them; and many were the experiments made by chemists in this direction; it was not, however, until 1868 that this was proved to be a mistake, and its relationship to anthracen was discovered by Graebe and Liebermann, who succeeded in preparing this coal-tar product from the natural alizarin itself.

Having obtained this important result, they turned their attention further to the subject, hoping to find some process by which alizarin could be produced from anthracen; in this they were soon successful.

The discovery of the artificial formation of alizarin was of great interest, inasmuch as it was another of those instances which have of late years become so numerous, namely, the formation of a vegetable product artificially; but the process used by Graebe and Liebermann was of little practical value, because too expensive for practical purposes.

Having previously worked on anthracen derivatives, it occurred to me to make some experiments on this subject, which resulted in the discovery of a process by which the colouring-matter could be economically produced on a large scale. Messrs. Caro, Graebe, and Liebermann about the same time obtained similar results in Germany; this was in 1869. Further investigation during that year yielded me a new process, by which "dichloranthracen" could be used in place of the more costly product anthraquinon, which was required by the original processes. I mention this, as most of the artificial alizarin used in this country up to the end of 1873, and a good deal since, has been prepared by this new process.

It was observed that when commercial artificial alizarin prepared from anthraquinon, but more especially from dichloranthracen, was used for dyeing, the colours produced differed from those dyed with madder or pure alizarin; and many persons therefore concluded that the artificial colouring-matter was not alizarin at all. This question, however, was set at rest by separating out the pure artificial alizarin from the commercial product and comparing it with the natural alizarin, when it was found to produce exactly the same colours on mordanted fabrics, to have the same composition, to give the same reactions with reagents, and to yield the same products on oxidation.

But whilst examining into this subject it was found that a second colouring-matter was present in the commercial product, and in somewhat large quantities, especially when dichloranthracen had been employed in its preparation; and to this was due the difference in shade of colour referred to.

This substance, when investigated, was found to have the same composition as "purpurin," also a colouring-matter found in madder, but of very little value on account of the looseness and dulness of some of the colours it produces. This new substance, being derived from anthracen, was named anthrapurpurin; unlike its isomer purpurin, however, it is of great value as a colouring-matter. I do not think I shall be going beyond the results of experience if I say it is of as great importance as alizarin itself; with alumina mordants it produces reds of a more scarlet or fiery red than those from alizarin. In fact, so fine are the colours produced that, with ordinary alumina mordants on unoiled cotton, it gives results nearly equal in brilliancy to Turkey-red produced with madder or garancin; and I believe the rapid success of artificial alizarin was greatly due to its presence. Most of that consumed at first was for Turkey-red dyeing; and the colours were so clear that it was mostly used in combination with madder or garancin, to brighten up the colours produced by these natural products.

The purple colours anthrapurpurin produces with iron mordants are bluer in shade than those of alizarin, and the blacks are very intense. Its application is practically the same as alizarin, so that they can be used in combination.

As already noticed, the commercial product called "artificial alizarin" first supplied to the consumer was always a mixture of alizarin and anthrapurpurin; and various mixtures of these two colouring-matters are still sent into the market; but, owing to the investigations that have been made and the study and attention that has been given to it by manufacturers, nearly pure alizarin and anthrapurpurin are also sent into the market—the first being known as "blue-shade alizarin," and the second as red or "scarlet alizarin."

The formation of anthrapurpurin in the manufacture of alizarin may to some extent be said to have arisen from a want of knowledge of the true conditions required for the production of the latter.

It is now well known that alizarin is a dioxyanthraquinon, or, in other words, anthraquinon in which two atoms of hydrogen are replaced by hydroxyl.

$$\underbrace{C_{14}H_8O_2}_{\text{Anthraquinon.}} \qquad \underbrace{C_{14}H_6(HO)_2O_2}_{\text{Alizarin.}}$$

If we want to introduce hydroxyl into a compound, there are several processes which can be used; but I will only refer to those connected with the history of this colouring-matter.

The first process which I will refer to has been used by chemists for a long period. It consists in first replacing the hydrogen by bromine, and then treating the resulting body with potassic or other metallic hydrate; and according as one, two, or more atoms of hydrogen have been replaced by the bromine, so on its removal by the metal of the metallic hydrate, a compound containing a corresponding number of atoms of hydrogen replaced by hydroxyl is obtained.

Graebe and Liebermann acted upon this principle in their experiments on the artificial formation of alizarin; and as it was necessary to replace two atoms of hydrogen in anthraquinon, they first of all prepared a dibrominated derivative, called dibromanthraquinon,

$$C_{14}H_6Br_2O_2.$$

By decomposing this with potassic hydrate at a high temperature, they obtained a violet-coloured product, which, when acidified to remove the alkali, gave a yellow precipitate of alizarin,

$$C_{14}H_6(HO)_2O_2.$$

The second process I wish to speak of for the replacement of hydrogen by hydroxyl in a compound is by converting it into a sulpho-acid (usually by means of sulphuric acid) and subsequently decomposing this with potassic or other hydrate; and, according as a mono- or disulpho-acid is employed, it yields on decomposition a compound with one or two atoms of hydrogen replaced by hydroxyl.

The discovery of sulpho-acids of anthraquinon, and their use in place of the brominated derivative originally employed by Graebe and Liebermann, constituted the great improvement in the manufacture of alizarin already referred to.

From what has just been stated, it was naturally supposed that a disulpho-acid of anthraquinon would be required to produce alizarin, and this was believed to be the case for some time; but further experiments have proved it to be a mistake, and shown that the mono-sulpho acid is required to produce alizarin, the disulpho-acid yielding anthrapurpurin.

But how are we to explain this apparent anomaly? It would take up too much time to enter into a discussion respecting the constitution of the sulpho-acids of anthraquinon in reference to the position of the HSO_3 groups. I will therefore confine my remarks to their decomposition.

Monosulphoanthraquinonic acid,—

$$C_{14}H_7(HSO_3)O_2,$$

when heated strongly with caustic alkali, as potassic or sodic hydrate, decomposes in the ordinary way, and we get "monoxyanthraquinon,"—

$$C_{14}H_7(HO)O_2,$$

which is a yellow body possessing no dyeing properties. On further treating this, however, with caustic alkali it changes, being oxidised, and yields alizarin,—

$$C_{14}H_6(HO)_2O_2.$$

Disulphoanthraquinonic acid,—

$$C_{14}H_6(HSO_3)_2O_2,$$

when subjected to the influence of caustic alkali, at first changes into an intermediate acid,—

$$C_{14}H_6(HO)(HSO_3)O_2,$$

and then into a dioxyanthraquinon,—

$$C_{14}H_6(HO)_2O_2,$$

now known as "isoanthraflavic acid,"—a substance having the same composition as alizarin, but being only an isomer of that body, and possessing no affinity for mordants. Like monoxyanthraquinon, however, when further heated with alkali it becomes oxidised, and yields a colouring matter, which is "anthrapurpurin,"—

$$C_{14}H_5(HO)_3O_2.$$

Looking at these reactions, it appears rather remarkable that Graebe and Liebermann should have succeeded in preparing alizarin from dibromanthraquinon. It can only be explained on the assumption that the hydrogen atoms replaced in the disulpho-acid are different in position from those replaced in the dibromanthraquinon; and of course it is possible that a disulpho-acid isomeric with that now known may be discovered that will yield alizarin as a first product on treatment with alkali.

In the reaction which takes place when monoxyanthraquinon or isoanthraflavic acid become oxidised and change into alizarin and anthrapurpurin nascent hydrogen is formed; and this causes a reverse action to take place—ordinary anthraquinon, or its hydrogen derivative, being formed, and a loss of colouring matter resulting. A small amount of potassic chlorate is now used with the caustic alkali, just sufficient to overcome the reducing action, which has resulted in an increased yield of colouring matter, the percentage obtained being now not very much below the theoretical quantity.

When the process for making commercial artificial alizarin by treating anthraquinon with sulphuric acid was first adopted, the product from that treatment was a mixture of the mono- and disulpho-acids of anthraquinon. Consequently, the colouring matter prepared in this manner was a mixture of alizarin and anthrapurpurin; and the reason why dichloranthracen, when used in place of anthraquinon, yields a product very rich in anthrapurpurin, is on account of the readiness with which it forms a disulpho-acid of dichloranthracen, which afterwards changes into the disulpho-acid of anthraquinon.

At first it was supposed by many that the quantity of coal-tar produced would not yield a sufficient supply of anthracen for the manufacture of artificial alizarin. Experience has, however, proved that this supposition was groundless, as now the supply is greater than the demand.

Moreover, some very interesting experiments have lately been made, by which anthraquinon and its derivatives have been obtained without the use of anthracen. The most interesting are those in which phthalic anhydride is employed with benzolic derivatives: for example, this anhydride gives with hydroquinon a colouring matter having the same composition, as well as most of the other properties of alizarin. It is called quinizarin. Baeyer and Caro have also obtained from phthalic anhydride and phenol oxyanthraquinon, and by using pyrocatechin in place of phenol they got alizarin itself.

Although these products have not been obtained in sufficient quantities by these processes to be of any practical value, we do not know what further research may do. Already one of the substances used is being prepared on the large scale for the manufacture of that beautiful colouring matter "eosin;" I refer to phthalic anhydride.

Now, with reference to the origin of the products which are used for the manufacture of artificial alizarin, we find the first researches made in reference to anthracen were by Dumas and Laurent in 1832; subsequently, Laurent further worked upon this subject, and obtained, by the oxidation of this hydrocarbon, a substance which he called anthracenuse; he also obtained dichloranthracen. Dr. Anderson also made an investigation on anthracen and its compounds in 1863, and assigned to it its correct formula; he re-examined its oxidation product, which Laurent called anthracenuse, and named it oxyanthracen, the substance we now know as anthraquinon.

All these substances were without any practical value until 1868; but we now find them of the greatest importance, and used daily in immense quantities.

But to bring out more clearly the practical importance of these fruits of scientific research, it will be well perhaps to see what has been their influence on the colouring matters which were in use before them, and also the extent of their present consumption.

The influence of the so-called aniline colours on dyewoods, &c., has been remarkably small. It is true that at first magenta had a depreciating influence upon cochineal; but this has passed away, and now the consumption o that dye is as great as ever; certainly its price is much lower than it used to be, but this is due to a variety of causes, especially the great increase in the cultivation of the insect at Teneriffe. And perhaps this want of influence is not so very remarkable when we consider the aniline colours are entirely new products, differing in composition and properties from the old colouring matters, and therefore could only displace them to a certain extent.

But whilst this is the case, the aniline colours have been more and more used, until at present it is computed that their annual sale in the United Kingdom and on the Continent exceeds £2,000,000. This is probably due to new applications and increase of trade.

When, however, we come to consider the influence of the anthracen colours, alizarin and anthrapurpurin, more generally known as "artificial alizarin," we find we have a very different tale to tell.

Here, in the case of alizarin, we have a competition not between two colouring matters, but the same from different sources—the old source being the madder-root, the new one coal-tar. And when we introduce the consideration of anthrapurpurin, which produces such magnificent reds, much brighter than alizarin or ordinary purpurin, we see we have not only a replacement but an improvement, so that these new colouring matters throw the old ones into the shade. The products being purer, the clearing processes for goods dyed with them are also necessarily easier and simpler.

It will be interesting to examine into the statistics of the madder and garancin trade in a brief manner, to see what has been the influence of artificial alizarin on their consumption. The following figures are mostly calculated from the Board of Trade returns.

During the ten years immediately preceding the introduction of artificial alizarin the average annual imports of madder into the United Kingdom were 15,292 tons, and of garancin 2278 tons. Estimating the value of the former at £2 2s. 6d., and the latter at £8 per cwt., which were about the average prices during that period, the annual value in round numbers was about one million sterling.

The introduction of artificial alizarin, however, has so influenced the value of madder that its price is now less than one-half; and thus a saving of over half a million sterling per annum has been effected to the manufacturers of the United Kingdom, one-half of which may be put down to Glasgow.

So much for its effect in reducing prices; but what has been its influence on the consumption of these dye-stuffs?

I have already stated the average quantity of these substances imported per annum prior to the discovery of the artificial product, and will now compare it with the imports of last year and this. That for the present year of course is an estimated quantity, and calculated from the returns for the first seven months.

	Average Annual Imports.		
	1852—1868. Tons.	1875. Tons.	1876. Tons.
Madder	15,202	5014	3653
Garancin	2278	1293	813

These figures speak for themselves.

The money value, which was formerly £1,000,000 per annum, is now, calculating from the estimated quantity for the year, only £138,105, say £140,000, taking garancin at £4 per cwt. and madder at £1 per cwt., prices slightly in excess of their present value.

At the present prices the cultivation of madder-roots is unremunerative; and it is to be expected that madder-growing will soon be a thing of the past, thousands of acres of land being at the same time liberated for the growth of those products which we cannot produce artificially, and without which we cannot exist. The quantity of madder grown in all the madder-growing countries of the world prior to 1868, was estimated to be 70,000 tons per annum; and at the present time the artificial colour is manufactured to an extent equivalent to 50,000 tons, or

more than two-thirds of the quantity grown when its cultivation had reached its highest point.

I might have referred to other subjects besides the coal-tar colours which have resulted from scientific research; but I know of no other of such interest and magnitude. From the brief history I have given, we see that the origin of these colouring-matters is entirely the fruit of many researches made quite independently by different chemists, who worked at them without any knowledge of their future importance; and on looking at the researches which have thus culminated in this industry, it is interesting to notice that many, if not most of them, were conducted for the purpose of elucidating some theoretical point.

These facts certainly ought to be a great encouragement to chemists, and stimulate them to greater activity. It would be very pleasing to see more work emanating from the chemical schools of the United Kingdom; and I think no student should consider his chemical curriculum finished until he has conducted an original research. The knowledge obtained by a general course of instruction is of course of very great value; but a good deal of it is carried on by rule. In research, however, we have to depend upon the exercise of our judgment, and, in fact, of all our faculties; and a student having once conducted even one, under the guidance of an efficient director, will find that he has acquired an amount of experience and knowledge which will be of the greatest value to him afterwards.

It is hoped these remarks will encourage young chemists to patiently and earnestly work at whatever subject they may undertake, knowing that their results, although sometimes apparently only of small interest, may contain the germ of something of great scientific or practical importance, or may, like a keystone in an arch, complete some subject which before was fragmentary and useless.

The following is a list of the Officers of Section B (Chemical Science):—

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ON THE TRIPOLITE OF BARBADOES.

By Dr. T. L. PHIPSON, F.C.S., &c.

A MOST remarkable deposit of tripolite exists in the island of Barbadoes, where it is mixed with a certain quantity of carbonate of lime. Under the microscope it is found to be exceedingly rich in remains of fossil infusoria, the forms of which are very well preserved. The silica is hydrated and soluble to a great extent in potash solution, and, like tripolite from other localities, it constitutes an excellent polishing material. On account of its value in this respect tripolite has many imitations in commerce, but it can be recognised at once by analysis, and also by the microscope. Below I give my analysis of a Barbadoes sample (a fair sample from many cwts. of this wonderful deposit) and that of a Swedish sample, together with two kinds of imitation tripolite met with in London:—

	Barbadoes.	Dagesfors, Sweden.
Silica	71·50	78·00
Oxide of iron and alumina	2·32	
Carbonate of lime	10·60	6·15
Phosphoric acid	0·08	
Combined water, with a minute quantity of organic matter	9·84	15·85
Moisture	5·66	
	100·00	100·00

	Imitations.	
Silica	1·0	84·7
$CaOCO_2$	88·4	6·1
Fe_2O_3, &c.	5·6	4·8
Water	5·0	4·4
	100·0	100 0

A sample of genuine tripolite from the Puy de Dome (France) gave:—Fournier: Silica, 87·2; water, 10·0; alumina, oxide of iron, &c., 2·8. Another sample from Algiers gave:—Salvétat: Silica, 80·0; water, 9·0; oxide of iron, alumina, lime, &c., 10·0. In all cases the silica is mostly soluble in strong boiling alkaline ley.

The genera most easily recognised in these deposits, with the aid of a moderately powerful microscope (200 to 260 diameters) are *Desmidium*, Euastrum, Xantidium, *Peridinium*, Gomphonema, Hemanthidium, *Pinnularia*, *Navicula*, *Actinocyclus*, *Pixidula*, Gallionella, Synedra, and *Bacillaria*. I have italicised those which appear to me most prominent in the Barbadoes deposit. Of these, Gallionella, Desmidium, Bacillaria, and Navicula are supposed to be plants, all the others to be animals. The great resemblance of these fossil animalcules to some of the active little beings in our ditches and stagnant waters is very striking.

Among other useful purposes to which the Barbadoes tripolite has been applied latterly, we may mention that, having been found a bad conductor of heat, it has been used with advantage for covering boilers. Boettger says tripolite will displace the aniline colours from their solution in spirit and fix them so that after awhile the solution filters colourless.

Laboratory of Analytical Chemistry,
Putney, S.W.

THERMOCHROMATISM, OR HEAT COLOURATION.

By MAJOR W. A. ROSS, late R.A.

MANY months ago, soon after the South Kensington Museum purchased a copy of my work, "Pyrology, or Fire Chemistry," in December, 1875, Mr. Valentin informed me in the chemical laboratory of that Museum that Mr. Ackroyd (one of his pupils) was "examining" my "ingenious" hypothesis published in that work as to the cause of the colours assumed by some heated substances.

I have just seen in the CHEMICAL NEWS (vol. xxxiv., p. 75) the result of this examination in an article called "Metachromatism," in which, however, my name is not mentioned, and ask you to do me the justice to publish

similarly in your valuable paper the following examination of his examen.

(1.) The term "metachromatism" applied to a *temporary* alteration of colour, is obviously a misnomer, for, without that adjective, it implies a *chronic* change; a substitution, in fact, of one colour for another, which phenomenon does not take place in the majority of these cases, while the principal producing agent—heat—remains in it utterly unrepresented. But while the term "metachromatism" is, as applied to heated bodies, in itself erroneous, what are we to think of the derivative "metachrome" with which, Mr. Ackroyd tells us, it will be "convenient" to label all "colour-changing" bodies? I should think, on the contrary, such a phraseology would be highly inconvenient, and might lead to serious results, if, for instance, a young gentleman, about to "pop the question," were to call the blushing "object of his affections" a "metachrome;" while the analogous misuse of classical derivatives would lead us to call a man a "poudinerement," because he has temporarily increased his weight by eating roast beef and plum pudding.

(2.) The term "thermochromatism" would therefore seem more suitable for this class of phenomena than that proposed by Mr. Ackroyd, while I cannot but think that the intolerable confusion between ideas of function and of form, implied by his other term "metachrome," should be carefully avoided.

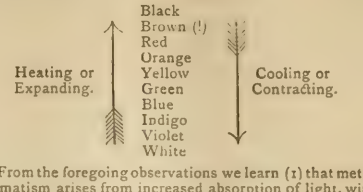
(3.) Although Mr. Ackroyd has not made the faintest reference to the article on colour in my published work above mentioned, which, according to Mr. Valentin, led to his investigations, he has, notwithstanding, done me the honour, under the disguise of a cloud of high-sounding but rather pedantic and frothy phrases, as "atomic potentiality," &c.—to come in the end to precisely the same conclusions as those recorded in my work; and to make this fact apparent, I make the following quotations:—

"Pyrology," p. 114 (1875).

"Substances whose particles can be agitated by vibrations of any kind, however minute, must have spaces between these, or pores; and if we can imagine vibrations having different amplitudes, it would not be difficult to assume the fact of pores having a corresponding magnitude, into some of which, for instance, waves of a comparatively greater amplitude, as red, could not pass, while violet vibrations would be freely admitted. If, then, we conceive an *expansion* of such light pores of heat, the rays of greater amplitude (of vibration) would pass into the *hot* body, and be gradually excluded as that cooled. It is a curious fact, with regard to this hypothesis, that oxide of bismuth—a metal which *expands* in cooling—proceeds in the other chromatic direction in cooling, viz., from D$_4$, or yellow, to white." This description is illustrated by a coloured lithograph (Plate II. of the work) representing a circular chromatic scale of the prismatic colours, with Frauenhofer's lettering, in which A, or red, exhibits the limit of coloured expansion, and H δ, or violetish red, the limit of coloured contraction; and these limits are surrounded by dotted arrows, showing the procedure of heated metallic oxides in either direction. White (as being the combination of all colours) concludes the scale at the limit of expansion, and black (as an absence of light) at that of contraction.

Mr. Ackroyd (1876).

"Hence when, at an early stage in its study, I saw that *nearly all metachromatic changes take place in a definite order—the order of the spectrum colours*—I was under the impression, even after much reading, that the subject was quite unworked. . . . . Expansion by heat is an all but universal law, so far as we at present know. . . . . Both classes (of oxides) alike owe their change to increased absorption of light, with elevation of temperature. . . . . Reflecting upon these facts, we see that it is possible to arrange the colours in order, and this I have done as follows:—



"From the foregoing observations we learn (1) that metachromatism arises from increased absorption of light, with elevation of temperature, the more refrangible increment increasing at a greater rate than the less refrangible; (2) that the only necessary concomitant is alteration of atomic potentiality; a change from the violet towards the red end of the metachromatic scale signifying atomic recession (pores expanding), and a change from the red towards the violet, atomic approach (pores contracting)."

(4.) In my work "Pyrology," above referred to, I have shown, both literally and graphically, how a solution of gold in phosphoric acid passes, in cooling, through all the prismatic colours from yellowish orange to bluish violet, and yet Mr. Ackroyd tells us he was the first "to see, at an early stage of study, that nearly all the changes take place in the order of the spectrum colours." (!)

(5.) I fear Mr. Ackroyd will find few scientific men, now-a-days, willing to confirm or allow his extraordinary assertion that "vibratory motion has little or nothing to do with the increased absorption of light by hot bodies," or that "black" is "a colour," or that "brown" is a "spectrum (prismatic) colour."

Stahl is evidently, though unadmittedly, cited by Mr. A. at second-hand, but I should feel obliged by information as to what part of his works "connects colour change with the varying amounts of phlogiston a body contains when heated." The observations of Stahl, with reference to the colours of heated bodies, seem to have been confined to iridescence ("evanescens colores variosa circa capellam formet qui ultimo iridis speciem præbebunt," &c. —"Fundamenta Chymiæ," vol. i., p. 162), and to the change of colour metals experience in alloys ("Per fusionem variæ mixturæ metallicæ formantur, et interdum quidem pro certi coloris gradu obtinendo," &c.—*Ibid.*, vol. iii., p. 187). But has Mr. A. neglected to cite, in his historical account, the observations of Boyle, a much greater man than "Stahl and followers" on this subject: —"Minerals also, by the action of the fire, may be brought to afford colours very different from their own," &c. (Boyle's Works, vol. ii., p. 72), or Bacon—"Metals give orient and fine colours in dissolutions" &c. ("Sylva Sylvarum," Century III., p. 75), merely because they were Englishmen, or because he is ignorant of their writings with reference to this matter?

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances, de l'Academie des Sciences. No. 6, August 7, 1876.

Experimental Critique on Glycæmia.—M. Claude Bernard.—The author shows that the existence of saccharine matter in the blood is not an accidental fact dependent upon alimentation, but constitutes a constant and permanent physiological phenomenon.

Observations of M. Thenard with reference to the above Communication.—The author maintains the existence of a special affinity, named by M. Chevreul capillary affinity.

Alteration of Urine.—M. L. Pasteur.—A continuation of the discussion on abiogenesis.

Reply to the Last Communication of M. Hirn.—M. A. Ledieu.—The author maintains that M. Hirn's researches lead merely to condemn the system of emission as an explanation of the movements of the radiometer of Mr. Crookes.

On Intensity Radiometers.—M. W. de Fonvielle.—Up to the present time the radiometers presented to the Academy differ merely as to the colour or the nature of the two contiguous faces of the discs. However, the dissymmetry of action necessary for rotation may be equally obtained by giving to the instrument a play of perfectly similar discs, the two faces of which may be of the same substance and the same colour; but in this case the discs must be of a helicoid form, whether convex or concave, or merely inclined to the axis of rotation; in a word, the dissymmetry of material or of colour must be replaced by dissymmetry of form. We may imitate the arrangement of the feather-mills, which we have seen at the toy dealers; that of cup anemometers; that of helices set in action by an aërial current; or that of orreries which are readily caused to turn by the electric currents of a Holtz machine. The axle itself does not require to remain vertical if—whilst giving it a horizontal or inclined position—care be taken not to create an exaggerated friction, for the radiometer will turn under the influence of the motor ray if the passive resistances do not exceed the fraction of the total impulsion which produces the rotation in the system adopted. Whatever may be the system adopted all the discs will collect a motor effort, forming an assignable fraction of the total impulsion, and the dynamic formulæ by means of which this element will be determined will be independent of any hypothesis as to the cause of the movement. These calculations will be closely analogous with those to which turbines and windmills have given scope. They cannot be executed with radiometers moving in virtue of the different colour of their discs. The author proposes to give to such apparatus the name of radiometers of intensity.

Determination of the Carbonic Acid contained in Waters (Waters of Irrigation, Drainage, Springs, Rivers, &c.).—M. A. Houzeau.—The method proposed consists in disengaging successively, in a gaseous state, the free and the combined carbonic acid, absorbing it in 5 c.c. of standard solution of soda containing $\frac{1}{100}$th part of oxide of zinc. The carbonic acid is then determined by a method which the author has previously published (*Annales de Chimie et de Physique*). The apparatus is composed of a flat-bottomed bottle, holding 750 c.c., and closed by a stopper which gives passage to two tubes. One of these, bent into the shape of an S, serves for the introduction of the sulphuric acid destined to liberate the combined carbonic acid after that which is free has been expelled by prolonged boiling. The other tube serves to conduct the carbonic acid gas into a flask, of the capacity of 210 c.c., where it meets with a portion of the standard soda solution, the remainder being in a Wills's tube connected with the flask by a caoutchouc stopper. When all the carbonic acid has been disengaged by boiling the water for a sufficient length of time, which takes place in ordinary cases when about 170 c.c. of water have been condensed in the flask containing the standard soda, the alkaline contents of this flask and of the Will-tube are poured into a test-glass on a foot, having a mark at 200 c.c., a neutral solution of chloride of barium is added in excess, and the liquid is made up to 200 c.c. with the washing-waters. The carbonate of baryta settles so rapidly that after it has stood for a few minutes 50 c.c. may be taken from the clear part of the liquid and its value determined with an acid representing exactly 2·0 of CO_2 per c.c. The difference between the strength of the soda solution *before* and *after* the absorption of the carbonic acid gas shows the volume of the standard acid corresponding to the carbonated soda; this volume, multiplied by 2, gives the weight of the carbonic acid. The author generally operates on $\frac{1}{4}$ litre of water.

New Process for the Qualitative Detection and the Determination of Potassa.—M. Ad. Carnot.—Inserted in full.

Different Rotatory Powers of Cane-Sugar According to the Method used for their Measurement.—M. L. Calderon.—The author finds a mean difference of 6·3°, according as he employs the process of Biot, or the monochromatic flame according to Jellet and Cornu.

Process for the Determination of Hydrocarbons, and in Particular the Fire-damp of Coal Mines.—M. J. Coquillion.—The author makes use of a wire of palladium heated to redness by the battery. The results enable him to estimate with a certain amount of accuracy the amount of fire-damp present in a give atmosphere.

Use of Chloride of Calcium for Watering Roads, &c.—M. Coustè.—The author has experimented with this process as early as 1854.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

An improved process of removing phosphorus from iron ores, and refining slag or scoriæ. G. Velge, Liège, Belgium. May 26, 1875.—No. 1924.—This invention consists in mixing with the phosphorus ores, or the slag or scoriæ, a quantity of alkaline bases or salts. This mixture being brought to a red-heat, a phosphate is formed, soluble in water or in water slightly acidulated, and the phosphorus may be separated from the iron by washing.

Improvements in the preparation of insulating compounds for coating electric telegraph wires, and other purposes. F. Field, Upper Marsh, Lambeth, Surrey, and R. Talling, Lostwithiel, Cornwall. May 27, 1875.—No. 1938.—This invention relates to insulating compounds prepared by the mixture of ozokerit, or the residue obtained from the distillation thereof with india-rubber, gutta-percha, and other insulating materials, as described in Matthiessen's Specification, No. 3778, of 1869. According to the present invention, instead of incorporating the ingredients by the application of heat, as described in the said Specification, whereby the resulting compound is rendered brittle, the ingredients are incorporated either by dissolving them by means of solvents, such as solar naphtha, and then mixing them together, or by masticating them together by any known mechanical means.

Improvements in the treatment of alunite, or of natural products containing the same, so as to obtain aluminous compounds therefrom. J. H. Johnson, Lincoln's Inn Fields, Middlesex. (A communication from La Societé Financiere de Paris, Paris.) May 25, 1875.—No. 1946. The essential features of this invention consist in the treatment of what is known as alunite, or of minerals containing alunite, so as to obtain potassic alum therefrom, which is effected by the employment of sulphuric acid, chloride of potassium, and alunite, or of minerals containing alunite, at an elevated temperature, in order that the chloride of potassium may be converted into sulphate of potash, and potassic alum be obtained from the result of calcination.

Improvements in the treatment of the excreta of towns. J. J. Coleman, F.C.S., Glasgow, Lanark, N.B. May 28, 1875.—No. 1954. The feature of novelty which constitutes this invention is treating the excreta by mineral oil works' spent shale in the manner set forth.

Improvements in the treatment of ferric, and aluminous and ferric matters, for the purpose of obtaining useful substances therefrom. E. and F. M. Spence, Newton Heath, Manchester, Lancaster. May 29, 1875.—No. 1961. This invention relates to the manufacture of ferric, and aluminous and ferric compounds, consisting of sulphate of iron and sulphate of alumina and iron.

ERRATUM.—A transposition occurs on page 73, line 29 from top. *For* "wool from grease" *read* "grease from wool."

NOTICE.

The STUDENTS' NUMBER of the CHEMICAL NEWS will be published on Friday next, September 15th. Gentlemen holding official positions in the Universities, Medical Schools, &c., of the United Kingdom, where Chemistry and Physical Science form a part of the education, who have not yet forwarded the necessary information to our Office for publication in that Number, will confer a favour by sending it with the least possible delay.

THE CHEMICAL NEWS.

Vol. XXXIV. No. 877.

UNIVERSITIES AND COLLEGES.

UNIVERSITY OF LONDON.

Candidates for any Degree granted by this University are required to have passed the Matriculation Examination, to which no candidate is admitted unless he has produced a certificate showing that he has completed his sixteenth year.

The Fee for this examination is £2.

The Examination will be held on Monday, January 8th, 1877. It is conducted by means of Printed Papers; but the Examiners are not precluded from putting, for the purpose of ascertaining the competence of the Candidates to pass, *viva voce* questions to any Candidate in the subjects in which they are appointed to examine.

Candidates are not approved by the Examiners unless they have shown a competent knowledge in each of the following subjects:—1. Latin. 2. Any two of the following Languages:—Greek, French, and German. 3. The English Language, English History, and Modern Geography. 4. Mathematics. 5. Natural Philosophy. 6. Chemistry.

The Papers in Latin and Greek will contain passages to be translated into English, with questions in Grammar and in History and Geography arising out of the subjects of the book selected. Short and easy passages will also be set for translation from other books not so selected. A separate paper will be set containing questions in Latin Grammar, with simple and easy sentences of English to be translated into Latin.

The papers in French and German will contain passages for translation into English, and questions in Grammar, limited to the Accidence.

The Latin subjects for 1877 and 1878 are—

For January 1877:—*Virgil*, Georgics, Book IV., and Æneid, Book IV.

For June 1877:—*Horace*, Odes, Books III. and IV.

For January 1878:—*Livy*, Book II.

For June 1878:—*Ovid*, Epistolæ ex Ponto, Book II.

Special stress is laid on accuracy in the answers to the questions in Latin Grammar.

The Greek subjects for 1877 and 1878 are—

For January 1877:—*Xenophon*, Hellenics, Book I.

For June 1877:—*Homer*, Odyssey, Book XII.

For January 1878:—*Homer*, Iliad, Book X.

For June 1878:—*Xenophon*, Hellenics, Book II.

Candidates may substitute German for Greek.

The Questions in Natural Philosophy are of a strictly elementary character; they include Mechanics, Hydrostatics, Hydraulics, Pneumatics, Optics, and Heat.

The Examination in Chemistry is—Chemistry of the Non-Metallic Elements; including their compounds—their chief physical and chemical characters—their preparation—and their characteristic tests.

A Pass Certificate, signed by the Registrar, will be delivered to each Candidate who applies for it, after the Report of the Examiners has been approved by the Senate.

If in the opinion of the Examiners any Candidates in the Honours Division of not more than Twenty years of age at the commencement of the Examination possess sufficient merit, the first among such Candidates will receive an Exhibition of thirty pounds per annum for the next two years; the second among such Candidates will receive an Exhibition of twenty pounds per annum for the next two years; and the third will receive an Exhibition of fifteen pounds per annum for the next two years; such exhibitions are payable in quarterly instalments, provided that on receiving each instalment the Exhibitioner declares his intention of presenting himself either at the two Examinations for B.A., or at the two Examinations for B.Sc., or at the First LL.B. Examination, or at the Preliminary Scientific and First M.B. Examinations, within three academical years* from the time of his passing the Matriculation Examination.

Under the same circumstances, the fourth among such Candidates will receive a prize to the value of ten pounds in books, philosophical instruments, or money; and the fifth and sixth will each receive a prize to the value of five pounds in books, philosophical instruments, or money.

Any Candidate who may obtain a place in the Honours Division at the Matriculation Examination in January is admissible to the First B.A. or to the First B.Sc. Examination in the following July. But such Candidate will not be admissible to the Second B.A. or to the Second B.Sc. Examination in the ensuing year, unless he has attained the age of eighteen years.

Several important changes have been made in the regulations relating to the Degrees in Science. These revised regulations relating to the *First* B.Sc. Examination will come into force at the Examination in July, 1877. Candidates presenting themselves at the *Second* B.Sc. Examination in October, 1877, will be allowed an option between the old and the revised regulations.

First B.Sc. Examination.

The First B.Sc. Examination will commence on the third Monday in July, 1877.

No Candidate (with the exception of such as have obtained Honours at the Matriculation Examination in the preceding January) is admitted to this Examination within one academical year of the time of his passing the Matriculation Examination.

The Fee for this Examination is £5.

The Examination embraces the following subjects:—Pure and Mixed Mathematics, Inorganic Chemistry, Experimental Physics, and General Biology.

In place of the superficial acquaintance with both Zoology and Botany, formerly required at the first B.Sc. examination, there will be a single examination (written and practical) in General Biology, in which a more thorough knowledge will be required of the simplest forms and elementary phenomena of Animal and Vegetable Life, such as is now made the basis of the teaching of some of the most distinguished professors in each department. Candidates will therefore be examined in the following subjects:—

Structure, functions, and life-history of simple Unicellular Plants, such as *Torula* and *Protococcus*, as types of Vegetable Life.

Structure, functions, and life-history of *Penicillium*, *Mucor*, or some other simple Fungus.

Structure, functions, and life-history of *Chara* or *Nitella*.

Morphology, histology, and history of the reproduction of a Fern.

Morphology and histology of a Flowering plant; structure of a flower; homologies of leaves and floral elements; histology of ordinary vegetable tissues, such as epidermis, parenchyma, fibro-vascular tissue, and their arrangement in the stem, branches, and leaves.

Growth of a Flowering plant; formation of wood and bark; nature of cambium.

Reproduction of a Flowering plant; structure of ovule; methods of fertilisation; development of ovule into seed.

* By the term "Academical Year" is ordinarily meant the period intervening between any Examination and an Examination of a higher grade in the following year; which period may be either more or less than a Calendar year. Thus the interval between the *First* Examinations in Arts, Science, and Medicine, and the *Second* Examinations of the next year in those Faculties respectively, is about sixteen months, whilst the interval between the Second B.A. Examination and the M.A. Examination of the next year, or between the Second B.Sc. Examination and the D.Sc. Examination of the next year, is less than eight months. Nevertheless, each of these intervals is counted as an "Academical Year."

General principles of Vegetable Nutrition; food of plants; action of green parts of plants; nature and flow of sap.

Structure, functions, and life-history of the following Animals, as types of some of the chief divisions of the Animal Kingdom:—*Amœba, Vorticella, Hydra*, Earthworm, Mussel, Snail, Lobster or Crayfish, Frog.

General histology of chief Animal tissues:—Blood; pavement, columnar, ciliated, and glandular epithelium; connective tissue; cartilage; bone; muscle; nerve-fibres and nerve-cells.

General physiology of Circulation, Respiration, and Digestion in the Frog, together with the fundamental properties of muscle, nerve, and the spinal cord.

Reproduction of Frog, and chief phases in life of tadpole.

Thus the student who may be intending to devote himself specially to Physical or Chemical Science will be brought to apprehend the general conceptions common to the two great Organic Kingdoms, without being required to master the specialities of either. And the student who intends to present himself at the second B.Sc. examination in either Physiology, Zoology, or Botany, or all combined, will have laid the best foundation for those special studies in the study of General Biology.

Examination for Honours.

Any Candidate who has passed the First B.Sc. Examination in all its subjects may be examined at the Honours Examination next following the First B.Sc. Examination at which he has passed for Honours in (1) Mathematics, (2) Experimental Physics, (3) Chemistry, (4) Botany, and (5) Zoology; unless he has previously obtained the Exhibition in Pure and Mixed Mathematics at the First B.A. Examination, in which case he will not be admissible to the Examination for Honours in that subject; or unless he has previously obtained the Exhibition at the Preliminary Scientific (M.B.) Examination in either of the subjects which are common to it with the first B.Sc. Examination, in which case he will not be admissible to the Examination for Honours in that subject.

Candidates for Honours in Chemistry will be examined in Inorganic Chemistry, treated more fully than in the Pass Examination. In addition, they shall be examined practically in Simple Qualitative and Quantitative Analysis. This Examination, which will consist of six hours' examination by printed papers and of six hours' practical work, will take place on Thursday and Friday in the same week with the Examination for Honours in Mathematics, commencing on each day at 10 a.m.

In the Examination for Honours, the Candidate, not being more than 22 years of age at the commencement of the Pass Examination, who most distinguishes himself in Chemistry or Experimental Physics, will receive an Exhibition of £40 per annum for the next two years.

SECOND B.SC. EXAMINATION.

The Second B.Sc. Examination will commence on Monday, October 23rd, 1877.

Candidates for this Examination are required to have passed the First B.Sc. Examination at least one academical year previously.

The Fee for this Examination is £5.

The regulations, which will be commenced on October 23rd, 1877, are framed with the view of allowing the candidate to bring up *any three* of the following nine subjects:—

1. Pure Mathematics.
2. Mixed Mathematics.
3. Experimental Physics.
4. Chemistry.
5. Botany, including Vegetable Physiology.
6. Zoology.
7. Animal Physiology.
8. Physical Geography and Geology.
9. Logic and Psychology.

It is intended that the examinations in these several subjects should be, as nearly as may be, on the same grade, as to the amount of attainment they require. The experience of the Examiners in Mathematics justifies them in stating that any candidate who has thoroughly mastered the Mathematics of the Fist B.Sc. Examination, and who has such an aptitude for the study as would lead him to select Pure Mathematics as one of his subjects at the Second, would find no difficulty in mastering the requirements of its programme, by such an amount of study, carried on through an eight months' Academical Session, as would leave him free to bestow the same amount of time and attention on *two* or even *three other* subjects. It is understood the amount of proficiency expected in each of the three subjects chosen will be that which the candidate might attain by the steady devotion to it of about one-third of the sessional work of a diligent student.

Examination for Honours.

Any candidate who has passed the Second B.Sc. Examination, and has not previously passed the Second B.A. Examination, may be examined at the Honours Examination next following the Second B.Sc. Examination at which he has passed, for Honours in (1) Mathematics, (2) Logic and Psychology, (3) Experimental Physics, (4) Chemistry, (5) Botany, (6) Zoology, (7) Physiology, (8) Physical Geography and Geology; provided that he shall have gone through the Pass Examination in the corresponding subject or subjects immediately before. And any Bachelor of Arts who has passed the Second B.Sc. Examination may under the same conditions be examined for Honours in one or more of the above mentioned subjects, unless he have previously obtained a Scholarship at the Second B.A. Examination in either of the first two of those subjects, in which case he shall not be admissible to the Examination for Honours in that subject.

The examination for Honours in Chemistry will take place on Monday and Tuesday in the week following the examination for Honours in Mathematics; on Monday by printed papers (chiefly on Organic Chemistry), and on Tuesday by practical exercises in Simple Qualitative and Quantitative Analysis.

The candidate, being not more than 23 years of age, who most distinguishes himself in Chemistry, will receive £50 per annum for the next two years, with the style of University Scholar.

DOCTOR OF SCIENCE.

The examination for the Degree of Doctor of Science takes place annually within the first twenty-one days of June, and the examination in each branch occupies four days.

No candidate is admitted to the examination for the Degree of D.Sc. until after the expiration of two Academical Years from the time of his obtaining the Degree of B.Sc. in this University, unless he shall have passed the Second B.Sc. Examination in the First Division at least two Academical Years subsequently to having passed the First B.Sc. Examination, in which case he shall be admitted to the examination for the Degree of Doctor in Science at the expiration of *one* Academical Year from the time of obtaining his B.Sc. Degree.

GILCHRIST SCHOLARSHIPS.

1. A Scholarship of the value of Fifty Pounds per annum, and tenable for three years, is annually awarded to the highest among those Candidates at the June Matriculation Examination who have been approved by the Principal of University Hall as fit to be received into that Institution with a view to the prosecution of their studies in University College for Graduation in one of the four Faculties of the University of London; provided that such Candidate pass either in the Honours List or in the First Division.—Particulars may be obtained on application to the Principal of University Hall, Gordon Square, W.C.

2. A similar Scholarship is annually awarded to the Candidate from the Royal Medical College, Epsom, who at the June Matriculation Examination stands highest among the Candidates approved by the Head Master of that Institution, and who passes either in the Honours List or in the First Division; on condition of his prosecuting his studies during the tenure of his Scholarship with a view to Graduation in one of the four Faculties of the University of London.—Particulars may be obtained on application to the Secretary of the Royal Medical College, 37, Soho Square, W.

3. A similar amount is annually offered to Candidates intending to pursue, at Owens College, Manchester, their studies for Graduation in one of the four Faculties of the University of London; a single Scholarship of Fifty Pounds per annum for three years being awarded to the highest of those Candidates at the June Matriculation Examination who shall have been previously approved by the Principal of Owens College, provided that he pass in the Honours Division; or, in case no Candidate should so pass, two Scholarships, each of Twenty-five Pounds per annum, being awarded to the two Candidates as aforesaid who shall stand highest in the First Division.—Particulars may be obtained on application to the Principal of Owens College, Manchester.

Particulars of the Colonial and Indian Scholarships may be obtained on application to the Secretary of the Gilchrist Educational Trust, University of London, W.

UNIVERSITY OF OXFORD.

Professor of Chemistry.—W. Odling, M.A., F.R.S.

Professor of Mineralogy.—N. S. Maskelyne, M.A., F.R.S.

Demonstrator of Chemistry.—T. H. G. Wyndham, M.A.

Analyst in Health Laboratory.—W. F. Donkin, M.A.

Every Student must reside in one or other of the Colleges or Halls, or in licensed lodgings, for a period of three years, passing at least two examinations in Arts, and one in either Mathematics, Natural Science, Law, Modern History, or Theology, when, if he obtain a first, second, or third class, he can take his B.A. Degree; if he do not gain such honour he has to pass a third examination in *Literis Humanioribus*.

The instruction in Natural Science is carried on at the Museum, where there is practical instruction in Physics, Chemistry, Anatomy, and several other departments of natural science, together with courses of lectures and of practical instruction and work, by the several professors.

Scholarships of about the value of £75 are obtainable at Christ Church, Magdalen, and other colleges, by competitive examination in Natural Science.

More detailed information may be obtained from the University Calendar; from the professors; from E. Chapman, Esq., M.A., Frewin Hall; and from the Sub-Librarian in the Radcliffe Library or the Museum.

UNIVERSITY OF CAMBRIDGE.

Professor of Chemistry.—G. D. Liveing, M.A.

Jacksonian Professor of Natural History.—J. Dewar, M.A.

Demonstrator.—J. W. Hicks, M.A.

The Student must enter at one of the Colleges, or as a Non-collegiate Student, and keep terms for three years by residence in the University. He must pass the previous examination in Classics and Mathematics, which may be done in the first or second term of residence, or, through the Oxford and Cambridge Schools Examination Board, before commencing residence. He may then proceed to take a Degree in Arts, either continuing mathematical and classical study, and passing the ordinary examinations for B.A., or going out in one of the Honour Triposes.

The scholarships, ranging in value from £20 to £80 a year, are chiefly given for mathematical and classical proficiency. Scholarships are given for Natural Science in Trinity, St. John's, St. Peter's, Clare, Christ's, Sidney, Pembroke, Caius, and Downing Colleges; the examinations being at Easter, and in June and October.

The Chemical Laboratory of the University is open daily for the use of the Students. The Demonstrator attends daily to give instructions.

Non-collegiate Students are allowed to attend certain of the College Lectures and all the Professors' Lectures, and have the same University status and privileges as the other Students. They are under the superintendence of the Rev. R. B. Somerset, Orford House, Cambridge, from whom further information may be obtained.

The following are the Lectures on Chemistry for the ensuing Academical Year:—

MICHAELMAS TERM, 1876.

General Course, by the Professor of Chemistry, on Mondays, Wednesdays, and Fridays, at 12 noon. Begin Oct. 13.

Spectroscopic Analysis, by the Professor of Chemistry, on Mondays, Wednesdays, and Fridays, at 1 p.m. Begin Oct. 16.

Qualitative Analysis, by the Professor and the Demonstrator of Chemistry. Daily. Begin Oct. 11.

Physical Chemistry, by the Jacksonian Professor, on Tuesdays, Thursdays, and Saturdays, at 12 noon. Begin Oct. 17.

The Principles of Qualitative Analysis, by Mr. Main, at St. John's College, on Tuesdays, Thursdays, and Saturdays, at 11 a.m. Begin Oct. 19.

Volumetric Analysis, by Mr. Apjohn, at Caius Laboratory, on Mondays, Wednesdays, and Fridays, at 10 a.m. Begin Oct. 18.

LENT TERM, 1877.

General Course continued, by the Professor of Chemistey, on Mondays, Wednesdays, and Fridays, at 12 noon. Begin Jan. 24.

Analysis, by the Professor or Demonstrator of Chemistry. Daily. Begin Jan. 24.

Organic Chemistry, by the Jacksonian Professor, on Tuesdays, Thursdays, and Saturdays, at 12 noon. Begin Jan. 23.

Elementary Course, by Mr. Main, at St. John's Laboratory, on Tuesdays, Thursdays, and Saturdays, at 11 a.m. Begin Feb. 1.

Non-metallic Elements, by Mr. Apjohn, at Caius Laboratory, on Mondays, Wednesdays, and Fridays, at 10 a.m. Begin Feb. 2.

EASTER TERM, 1877.

Some Special Department, by the Professor of Chemistry, on Mondays, Wednesdays, and Fridays, at 12 noon. Begin April 18.

Analysis, by the Professor or Demonstrator of Chemistry. Daily. Begin April 16.

Laboratory Instruction in Chemical Research, by the Jacksonian Professor. Times to be announced hereafter.

Elementary Inorganic Chemistry, by the Demonstrator of Chemistry, on Tuesdays, Thursdays, and Saturdays, at 3 p.m.

Elementary Course concluded, by Mr. Main, at St. John's Laboratory, on Tuesdays, Thursdays, and Saturdays, at 12 noon. Begin April 17.

Organic Analysis and Elementary Organic Chemistry. by Mr. Apjohn, at Caius Laboratory, on Mondays, Wednesdays, and Fridays, at 10 a.m. Begin April 18.

SCIENCE AND ART DEPARTMENT OF THE COMMITTEE [OF COUNCIL ON EDUCATION, SOUTH KENSINGTON,

AND

ROYAL SCHOOL OF MINES, JERMYN STREET.

A sum of money is voted annually by Parliament for scientific instruction in the United Kingdom. The object of the grant is to promote instruction Science,

especially among the industrial classes, by affording a limited and partial aid or stimulus towards the founding and maintenance of Science schools and classes.

The assistance granted by the Science and Art Department is in the form of—1. Public Examinations, in which Queen's Medals and Queen's Prizes were awarded, held at all places on complying with certain conditions. 2. Payments on results to teachers. 3. Scholarships and Exhibitions. 4. Building Grants. 5. Grants towards the purchase of apparatus, &c.

The following Courses of Lectures, Demonstrations, and Practical Laboratory instruction are given at South Kensington :—

Chemistry, by Professor Frankland, D.C.L., F.R.S. A Course of Forty Lectures on Mineral Chemistry, commencing October 2, 1876. A Course of Thirty Lectures on Organic Chemistry, commencing January 15, 1877. Fees—Lectures on Mineral Chemistry, £4; Lectures on Organic Chemistry, £3; together, £6.

Chemical Laboratories.—The Laboratories for instruction in chemical manipulation, in qualitative and quantitative analysis, the technical application of analysis, and in the method of performing chemical researches, are under the direction of Dr. Frankland, and will be opened on Monday, October 2, 1876. The Laboratories at South Kensington Museum are now used for the instruction of the Pupils of the Royal School of Mines.

The charge for instruction in the Chemical Laboratory is £12 for three mouths, £9 for two months, and £5 for one month.

Physics, by Professor Frederick Guthrie, F.R.S. The Course will consist of about Sixty Lectures, with Laboratory work on the subject of the Lectures.* The Course will commence on October 4, 1875. Fee for Lectures and Laboratory work, £10.

Metallurgy, by Dr. Percy, F.R.S. The Course will consist of about Fifty Lectures, commencing on October 10, 1875.

Metallurgical Laboratory.—This Laboratory is conducted by Mr. R. Smith, under the direction of Dr. Percy, and is devoted to practical instruction in Metallurgy, especially in Assaying. The nature of this instruction will be adapted to the special requirements of the Student. It comprises :—Assaying in all its branches, especially of the more important metals, such as iron, copper, lead, tin, alloys of silver and gold, &c.; and the examination of ores and metallurgical products.

The ability of the Student to make trustworthy assays is in every case thoroughly tested; and no certificate of competency is given to a Student who has not furnished satisfactory proof that he is able to obtain accurate results.

The charge for instruction in the Metallurgical Laboratory is £15 for three months, £12 for two months, and £7 for one month.

Besides the Students entering for the Associateship of the Royal School of Mines, and Teachers in Training, only such a limited number of occasional public Students will be admitted as can be accommodated. Letters with respect to the foregoing Courses should be addressed to the Secretary, Science and Art Department, South Kensington, London, S.W.

Lectures to Working Men.—Short Courses of Lectures at suitable periods of the year are given in the evening to Working Men. These courses are systematic, and arranged so as to illustrate, within a period of two years, the principal subjects taught at the institution. Those for the ensuing Session include Chemistry, Mineralogy, and Applied Mechanics.

EXHIBITIONS, SCHOLARSHIPS, AND PRIZES.

There are various Exhibitions, Scholarships, and free admissions attached to the School. They are as follow :—

Royal Exhibitions.

There are nine Royal Exhibitions to the Royal School of Mines, Jermyn Street, of the value of £50 per annum, entitling the holders to free admission to all the lectures and the chemical and metallurgical laboratories at the Royal School of Mines, to be held from year to year for three years, on the condition that the holder attends the courses regularly during those years, complies with all the rules laid down for his guidance, and passes the examinations required for the associateship of the school.

Free Admissions.

A free admission, conferring the privilege of attending all Lectures and Examinations without the payment of fees, is offered to any person who obtains a Queen's Gold Medal at the annual May Examinations of the Science and Art Department.

Royal Scholarships.

Two Scholarships, of fifteen pounds each, are given to the Students who shall stand highest on the list of those who have passed their Examinations for the first year; and a Scholarship of twenty-five pounds to that pupil who has gained the greatest number of marks in the examinations of the first two years.

KING'S COLLEGE.

(DEPARTMENT OF ENGINEERING AND APPLIED SCIENCE.)

Professor of Chemistry.—C. L. Bloxam, F.C.S.
Demonstrator.—W. N. Hartley, F.C.S.
Assistant Demonstrator.—J. M. Thompson, F.C.S.

I. For Students intending to devote themselves to Engineering, Manufacturing Chemistry, Mining, Scientific Chemistry, Commerce, Agriculture, Manufactures, Military Science, the Civil Service, and for those who are studying Chemistry for the sake of general information and as part of a liberal education. A Course of between fifty and sixty Lectures, by the Professor, carried on during the whole academical year. This Course is of such a character that Students may enter, without serious disadvantage, at the commencement of either of the College Terms. On Tuesday and Friday, from 10.20 till 11.20. Fee, £3 3s. a term, or £8 8s. for the year.

II. For Students who have any Examination in prospect, or who require general guidance in their Chemical studies. A Course of ten or twelve Lectures in each College Term, by the Assistant Demonstrator. On Saturday, from 11.15 till 12.15. Fee, £1 1s. for each term.

EVENING CLASSES.

For Students who are preparing for any Examination, or who require a general knowledge of Chemistry applicable to any pursuit.

A. A Course of about forty Lectures, by the Demonstrator, commencing in October and terminating in March. On Monday and Thursday evenings, from 7 till 8. Fee, £1 11s. 6d. for the Course.

B. A Summer Course of about ten Lectures, in April, May, and June. On Monday evenings, from 6.30 till 7.30. Fee, £1 1s. for the Course.

PRACTICAL CHEMISTRY.

For the study of Chemical Analysis of Inorganic and Organic Substances, as far as it is required in most Examinations. This Course is also preliminary to the study of Practical Chemistry in general.

Each Student works independently in the Laboratory, which is open in October, November, December, January, February, March—On Tuesday evening, from 7 till 9 p.m. Fee, £2 2s. for the Course.

II. May, June, July—On Monday, Tuesday, Wednesday, and Thursday, from 10.15 till 12.15 a.m. Fee, £5 5s. for the Course.

III. Each College Term—On Tuesday and Friday, from 10.20 till 11.40. Fee, £4 4s. per Term.

* A detailed account of the Laboratory Instruction in Physics will be found in the Student ' Number of the CHEMICAL NEWS for 1875 (No. 821).

LABORATORY OF ANALYTICAL AND EXPERIMENTAL CHEMISTRY.

For the study of all branches of Practical Chemistry.

Each Student works independently in the Laboratory, which is open during all College Terms, on every day (except Saturday) from 10 till 4, and on Saturday, from 10 till 1. Fees, Experimental and Analytical Chemistry —One month, £4 4s.; three months, £10 10s.; six months, £18 18s.; nine months, £26 5s.

UNIVERSITY COLLEGE.

FACULTY OF SCIENCE.

Chemistry.—Professor Williamson, Ph.D., F.R.S.
Assistant Professor.—Charles Graham, D.Sc.

A. General Course.

Lectures daily (except Saturday) from 11 to 12 a.m., up to the last week in March.

Exercises on Tuesdays, Wednesdays, Thursdays, and Fridays, from 9 to 10 a.m.

Fee for the whole Course of Lectures, £7 7s.; for the First or Second Half Course separately, £4 4s.; for the Second Half, when the first has been taken, £3 3s.; Perpetual, £9 9s.; for the Organic Course alone, £2 2s.

Fee for the Exercise Class, £2 2s.

The instruction in this Class is of two kinds, consisting partly of Experimental Lectures by the Professor, partly of Exercises and personal instruction on the subject of the Lectures by the Assistant Professor.

A weekly *viva voce* examination is held during the First Half Course and the commencement of the Second Half Course.

Organic Chemistry commences in the second week in February, and occupies five Lectures weekly till about the end of March.

Teachers of Chemistry are trained in the theory and practice of their profession. A two years' Course is absolutely requisite for this purpose; but Students will with advantage devote a longer period to it.

The first year is occupied with attendance on the Courses of Chemistry and of Analytical Chemistry. In the second year the Student again attends the Course of Chemistry, and is entrusted with teaching work in conjunction with the Tutors of the Class. At the same time he continues to work in the Laboratory at analysis and original research.

In order to qualify themselves for rising to the higher ranks of the Profession, gentlemen remain for a further period, in which case they may obtain remunerative work in teaching through the recommendation of the Professor.

B.—Analytical and Practical Chemistry.

I. *Birkbeck Laboratory.*

The Laboratory and offices are open daily from 9 a.m. to 4 p.m., from the 2nd of October until the end of July, with a short recess at Christmas and at Easter. Saturday, from 9 to 2.

Fees, for the Session, 25 guineas; six months, 18 guineas; three months, 10 guineas; one month, 4 guineas; exclusive of the expense of materials.

II. *Summer Courses.*

1. *Elementary Course.*—About forty Lessons, of one hour each, on Tuesday, Wednesday, Thursday, and Friday, from 11 to 12, commencing in the first week of May.

Fees, including the cost of materials and apparatus, for the Course, £4 4s.; Perpetual, £7 7s.

2. *Senior Course.*—This Course consists of twenty Lessons of two hours each, on Mondays and Saturdays, from 10 to 12, commencing in the first week in May.

Fees, including cost of materials and apparatus, for the Course, £4 4s.; Perpetual, £7 7s.

UNIVERSITY COLLEGE, BRISTOL.

Professor of Chemistry.—E. A. Letts, Ph.D., F.R.S.E.
Assistant Lecturer.—W. W. J. Nicol, M.A.

Scholarships.

The following Scholarships will be offered in October:—

One Chemical Scholarship of the value of £25, tenable for one year.

Subjects of examination:—1st. A qualifying examination in the subjects required for the General Scholarships. 2nd. A Special Competitive Examination in Chemistry, both written and practical.

Three General Scholarships of the value of £15 each, tenable for one year.

The successful candidates for these General Scholarships will be required to attend at least three subjects of Lectures and Classes at the College.

The Examinations will begin on Tuesday, the 3rd of October, at 10 a.m., and will be held at the College, Park Row, Bristol. The minimum age for Candidates is fixed at sixteen.

The following will be the subjects of Examination:—English Grammar and Composition, and Elementary Mathematics. In addition to these, each Candidate will be expected to offer at least one subject from the following list, but will not be allowed to offer more than three:—(1) Latin; (2) French; (3) German; (4) some period of English History; (5) some period of English Literature; (6) Chemistry; or (7) some other branch of Natural Science; (8) some portion of higher Mathematics; (9) Political Economy; (10) Physical and Political Geography of Europe.

The First Session will be divided into Three Terms. The First Term will commence on the 10th of October and end on the 20th of December, 1876. The Second Term will commence on the 10th of January and end on the 28th of March, 1877. The Third Term will commence on the 10th of April and end in July, 1877.

Inorganic Chemistry.

This Course will consist of Three Lectures a week, and will be continued during the First and Second Terms. They will be devoted to a consideration of the Theory of Chemistry, Chemical Physics' and Descriptive Inorganic Chemistry. In treating of the various substances under the latter heading, special attention will be given to their applications in the arts and manufactures. Fee, £3 3s.

Organic Chemistry.

The Course will consist of about forty Lectures, devoted to a consideration of the Carbon Compounds, and to a general examination of the leading groups of Organic Substances. Special attention will be given to the applications of Organic Chemistry to the Arts and Manufactures, more particularly to Dyeing and the Manufacture of Sugar, Soap, Coal Tar products, &c. Fee, £1 1s.

Laboratory Instruction.

The College Laboratory will be open daily at 10 a.m. Instruction will be given in the Laboratory in all branches of Practical Chemistry, including Qualitative and Quantitative Inorganic and Organic Analysis, the preparation of Chemical Products, and Inorganic and Organic Research, special facilities being afforded to those who desire to study Practical Chemistry, as applied to the different processes employed in the Arts and Manufactures. Each Student will be required to provide, at his own expense, a set of ordinary apparatus at a cost of about 21s. The cost of material for original research must also be paid by the student requiring it.

Fees—per Session:—Students working 6 days per week, £18 18s.; 3 days per week, £10 10s. Per Term:—Students working 6 days per week, £7 7s.; 3 days per

week, £4 4s. Per Month:—Students working 6 week, £3 3s.; 3 days per week, £2 2s.

Evening Classes.

A Course devoted to Chemical Technology. Fee, 10s.

ROYAL AGRICULTURAL COLLEGE, CIRENCESTER.

Chemical Department.

Professor of Chemistry —A. H. Church, M.A. Oxon.

The Collegiate year is divided into two Sessions, one beginning in February and ending in June, the other beginning in August, dividing in October, and ending in December.

During each Session the following Courses are given:—

36 Lectures on Inorganic Chemistry.
36 Lectures on Organic Chemistry.
36 Lectures on Agricultural Chemistry.
36 Laboratory Lessons in Chemical Manipulation.
36 Laboratory Lessons in Qualitative Analysis.
36 Laboratory Lessons in Quantitative Analysis.

The College Laboratory is open every day, except Saturday, from 9 a.m. till 5 p.m.

Advanced Students have the privilege of working at all times when the Laboratory is not occupied by other classes.

YORKSHIRE COLLEGE OF SCIENCE, LEEDS.

Professor of Chemistry.—T. E. Thorpe, Ph.D., F.R.S.E., F.C.S.

Lecture Courses.

1. General Course on Inorganic and Organic Chemistry —Monday, Tuesday, Wednesday, and Thursday, at 4 p.m., from October to the end of March. Fee for the Course, £4 4s.

2. Lectures on Laboratory Practice and Chemical Calculations—Thursday, at 10 a.m., from October to the end of March. Fee, 1s. 1s.

3. Lectures on the Chemistry of the Non-Metals—Saturday, at 12 a.m., from October to March. Fee, 0s. 6d.

Laboratory Courses.

Professor T. E. Thorpe, Ph.D., F.R.S.E.

The College Laboratory will be open daily from 9 a.m. to 1 p.m., and from 2 to 5 p.m., except on Saturdays, when it will close at 1 p.m.

Fees for the Session—Students working six days per week, £17 17s.; four, £13 13s.; three, £11 11s.; two, £8 8s.; one, £4 4s.

Special fees for shorter periods—For six months, six days per week, £13 13s.; five, £11 11s.; four, £9 9s.; three, £7 7s.; two, £5 5s.; one month, £3 3s.

Class in Practical Chemistry, Saturday mornings, from 9 to 12, from October to March. Fee, £1 11s. 6d.

Practical Chemistry for Medical Students.—On Monday and Wednesday, from 9 to 11 a.m., from May to the end of July.

COLLEGE OF PHYSICAL SCIENCE, NEWCASTLE.

(In connection with the University of Durham.)

Chemistry.—Professor—A. Freire-Marreco, M.A. *Demonstrator*—J. T. Dunn, Assoc. Phys. Science.

Practical Chemistry.—The Laboratory is open from 10 a.m. to 1 p.m., and from 2 to 5 p.m., except on Saturdays, when it closes at 1 p.m. *Laboratory Fees.*—Students working six days per week, £5 5s. per term; alternate days, £3 3s.; one day per week, £1 1s.

Arrangements for Laboratory work in the evening and during vacation will be made.

Courses of Study.—Students will be distinguished into Regular and Occasional. Regular Students will be required to follow such a course of study in the subjects professed in the College as will enable them to pass the Examinations for the title of Associate in Physical Science. Occasional Students will attend such classes as they may select.

The Session will commence on the 2nd October, 1876.

Evening Classes.—Professor A. Freire-Marreco, M.A. Twelve Lectures on the Principles of Modern Chemistry, and its relation to other Molecular Forces. Mondays, at 7.45, commencing October 30, 1876.

OWENS COLLEGE, MANCHESTER.

Professor and Director of the Chemical Laboratories.—H. E. Roscoe, B.A., Ph.D., F.R.S., F.C.S.

Professor of Organic Chemistry.—C. Schorlemmer, F.R.S.

Demonstrators and Assistant Lecturers.—Mr. W. C. Williams, F.C.S., and Mr. M. M. Pattison Muir, F.R.S.E.

Hon. Demonstrators.—Mr. Thomas Carnelley, B.Sc., and Mr. Oswald Wilkinson.

Lecture Courses.

Systematic Chemistry.—Junior Class.—Tuesday, Thursday, and Saturday, from 9.30 to 10.30 a.m., during Michaelmas and Lent Terms. Comprising—(1) The laws of Chemical Combination; (2) a description of the physical and chemical properties and the mode of preparation of the Non-Metallic Elements and of their compounds.

Senior Class.—Monday, Wednesday, and Friday, from 9.30 to 10.30 a.m., during the Michaelmas and Lent Terms, comprising—(1) The Chemistry of the Metals and of their most important compounds; (2) Organic Chemistry.

The instruction in Systematic Chemistry is given by means (*a*) of Experimental Lectures and (*b*) of Tutorial Classes.

Fee—For each Class, £2 12s. 6d.; for both Classes, £4 14s. 6d.

A Tutorial Class, meeting in Sections, will also be held, which all members of the Junior and Senior Classes will be required to attend, unless specially exempted by the Principal and the Professor. Extra fee for this Class, 10s. 6d. This fee is not included in the composition fees payable by regular Students.

Organic Chemistry.—Professor C. Schorlemmer, F.R.S. Tuesday, Thursday, and Friday, from 2.30 to 3.30 p.m.

The subject of this Course is the Chemistry of the Carbon Compounds, wherein the branch of Organic Chemistry is more fully and completely treated than in the general Course in Systematic Chemistry.

Fee, £3 10s.

Technological Chemistry.—Monday and Wednesday, from 2.30 to 3.30 p.m.

The chemical principles involved in the most important Chemical Manufactures will chiefly be considered in this Course. The subject will be discussed as follows:—

1. Twenty Lectures on Water and Air and the Chemistry of the Alkali Manufacture, by Professor Roscoe.

2. Twenty Lectures on the Chemistry of Colouring Matter, Dyeing, and Calico Printing, by Professor Schorlemmer.

Students attending this Class must be acquainted with the principles of chemical science.

Fee, £1 11s. 6d.

Chemical Philosophy.—Professor C. Schorlemmer, F.R.S. Saturday, from 9.30 to 10.30 a.m.

Sketch of the History of Chemistry; Development of Modern Chemistry; Chemical Laws and Theories; Relation of Chemistry to Physics.

Fee, £1 11s. 6d.

Analytical Chemistry.—Mr. W. C. Williams, F.C.S. Thursday, from 10.30 to 11.30 a.m.

This course will treat of the methods of Qualitative and Quantitative Analysis, and is intended to supplement the instruction in Practical Chemistry.

Fee, £1 11s. 6d.

Analytical and Practical Chemistry.

LABORATORY COURSES.

The Chemical Laboratories will be open for Students daily from 9.30 a.m. until 4.30 p.m., except on Saturdays, when they will be closed at 12.30 p.m.

Fees for the Session—For six days per week, £21; for four days per week, £17 17s.; for three days per week, £13 13s. Students entering the Laboratory Class at or after Christmas will be charged two-thirds of the fees for the whole Session.

Fees for shorter periods—For six months, £17 17s.; for five months, £15 15s.; for four months, £13 13s.; for three months, £10 10s.; for two months, £7 7s.; for one month, £4 4s. Students entering under this scale are entitled to work on every day during the week.

ROYAL COLLEGE OF SCIENCE FOR IRELAND, STEPHEN'S GREEN, DUBLIN.

Professor of Practical and Theoretical Chemistry.—R. Galloway, F.C.S.

Professor of Experimental Physics.—W. F. Barrett, F.R.S.E., F.C.S.

The Chemical and Metallurgical Laboratories, under the direction of Mr. Galloway, are open every week-day during the Session, except Saturday. Instruction is given in the different branches of Analytical Chemistry, including Assaying, and in the methods for performing Chemical Research. Fee, for the Session of nine months, £12; or for three months, £5; or for one month, £2.

There are four Royal Scholarships of the value of £50 each yearly, with Free Education, including Laboratory Instruction, tenable for two years; two become vacant each year; they are given to Students who have been a year in the College. There are also nine Exhibitions attached to the College, of the yearly value of £50 each, with Free Education, including Laboratory Instruction, tenable for three years; three become vacant each year.

A Diploma of Associate of the College is granted at the end of the three years' course.

The Session commences on Monday, October 2nd.

ANDERSONIAN UNIVERSITY, GLASGOW.

DEPARTMENT OF SCIENTIFIC CHEMISTRY.

Professor of Chemistry.—W. Dittmar, F.R.S.E., &c.

Young Professor of Technical Chemistry.—Dr. E. J. Mills, F.R.S.

CHEMICAL LECTURES, CLASSES, AND LABORATORY INSTRUCTION.

BERNERS COLLEGE OF CHEMISTRY AND THE EXPERIMENTAL SCIENCES, 44, Berners Street, W.—Prof. E. V. Gardner, F.A.S., M.S.A. The Laboratory is open morning and evening throughout the year.

BIRKBECK LITERARY AND SCIENTIFIC INSTITUTION.—Mr. G. Chaloner, F.C.S. Tuesdays, 8.30 to 9.30 p.m. Manipulation and Analysis, Saturdays, 7 to 10 p.m.

CITY OF LONDON COLLEGE, 52, Leadenhall Street, E.C.—Chemical Lecturer, Thos. Eltoft, F.C.S. Mondays, 7.30 to 8.30 p.m. Fee 6s. per term, or 15s. per session.

NORTH LONDON SCHOOL OF CHEMISTRY AND PHARMACY, 54, Kentish Town Road, N.W.—Mr. J. C. Braithwaite. The classes meet daily at 8 p.m. Fee 10s. 6d. per month. The Laboratory is open for Instruction in Practical Chemistry.

ROYAL POLYTECHNIC COLLEGE.—Chemical Lecturer, Mr. Thomas Eltoft, F.C.S. The Annual Course consists of three terms, each averaging ten Experimental Lectures. 7.30 p.m. Fee 6s. per term, Session 15s. Practical Chemistry, T. Eltoft, F.C.S.; fee, 12s. per term.

ROYAL VETERINARY COLLEGE, Camden Town.—Professor of Chemistry, Mr. R. V. Tuson.

CHEMICAL LECTURES AT LONDON HOSPITALS.

Chemical Schools and Colleges.	Winter Session.				Summer Session.			
	Lecturers on Chemistry.	Days and Hours.	Fees.		Lecturers on Chemistry.	Days and Hours.	Fees.	
			One Course.	Perpetual.			One Course.	Perpetual.
			£ s.	£ s.			£ s.	£ s.
St. Bartholomew's Hosp. and College	Dr. Russell, F.R.S.	M. W. F., 9	5 5	7 7	Dr. Russell	M. Tu. F., [10 to 1 11	2 2	3 3
Charing Cross Hospital and College	Mr. Heaton	M. W. F., 11	5 5	7 7	Mr. Heaton	M. F.	2 2	
St. George's Hospital	Dr. Noad, F.R.S.	Tu. Th. S., 11½	6 6	8 8	Dr. Noad	Da by 10	4 4	
Guy's Hospital	Dr. Debus, F.R.S., and Dr. Stevenson	Tu. Th. S., 11	5 5		Dr. Debus	M. W. F., 10 to 1	4 4	
King's College and Hosp.	Mr. Bloxam, F.R.S., and Mr. Hartley	Th. S., 10½	7 7	10 10	Mr. Bloxam and Mr. Hartley	M. W. F., 10½	5 5	8 8
London Hospital	Dr. Tidy	M.[Tu. W. Th., 11	7 7	7 7	Dr. Tidy	M. Th. S., 9	2 2	3 3
St. Mary's Hospital	Dr. Wright	M. W. Th., 4	4 4	6 6	Dr. Wright	Tu. F. S.	3 3	
Middlesex Hospital	Dr. Greenhow	M. W. Fr., 9	6 6	8 8	Mr. W. Foster	M. W. F., 3	3 3	
St. Thomas's Hospital and School	Dr. Bernays	Tu. Th. F., 12	7 7	9 9	Dr. Bernays	Tu. Th. S., 10	4 4	7 7
University Coll. & Hosp.	Dr. Williamson, F.R.S., and Dr. Graham	Daily (ex. S.) 11			Dr. Williamson & Dr. Graham	Daily (ex. S.) 11		
Westminster Hospital	Dr. Dupré, F.R.S.	W. Th. F., 3	5 5		Dr. A. Dupré	M. W. F., 10	3 3	

SCHOOL OF PHARMACY OF THE PHARMACEUTICAL SOCIETY OF GREAT BRITAIN, 17, Bloomsbury Square.—The school opens on Monday, the 2nd of October. Lectures on Chemistry and Pharmacy, by Professor Redwood, on Monday, Tuesday, and Wednesday mornings, at 9 a.m. The Laboratories for Practical Instruction in Chemistry as applied to Pharmacy, &c., under the direction of Prof. Attfield, will be open daily at 10 a.m. throughout the Session.

SOUTH LONDON SCHOOL OF CHEMISTRY, 325, Kennington Road.—Dr. John Muter, F.C.S. Daily, at 10 a.m. The Laboratory is open daily for Practical Instruction.

BIRMINGHAM.—MIDLAND INSTITUTE.—Mr. C. J. Woodward, B.Sc. Tuesday and Thursday, at 8 p.m.; Friday, at 7; and Saturday, at 3.

Birmingham.—Queen's College.—A. C. Bruce, M.A. Tuesday, Thursday, and Friday, at 12.

Liverpool Royal Infirmary School of Medicine.—J. Campbell Brown, D.Sc. Lond.,, F.C.S.

School of Technical Chemistry, 7 and 9, Hackin's Hey, Liverpool.—Mr. A. Norman Tate. 9.30 a.m. Evening Laboratory Instruction.

College of Chemistry, Liverpool—Mr. Martin Murphy, F.C.S. The Laboratories are open from 10 a.m. to 5 p.m. daily.

Leeds Mechanics' Institution.—Mr. G. Ward, F.C.S.

Manchester Grammar School.—Mr. Francis Jones, F.C.S., F.R.S.E.

Manchester Mechanics' Institution.—Mr. M. A. Watts, M.A. Friday, 7.15 p.m.

Queenwood College, near Stockbridge, Hants.—Mr. E. W. Prevost, Ph.D., F.C.S., F.R.S.E.

Sheffield Borough Analysts' Laboratory, 1 and 3, Surrey Street.—Mr. A. H. Allen, F.C.S. Day and Evening Classes.

Sheffield School of Medicine.—Mr. A. H. Allen, F.C.S.

University of Aberdeen.—Prof. J. S. Brazier.

Aberdeen School of Science and Art Mechanics' Institution.—Mr. Thomas Jamieson, F.C.S.

University of Edinburgh.—Prof. A. Crum Brown, F.R.S.E.

School of Medicine, Edinburgh.—Dr. Stevenson Macadam, F.R.S.E., and Mr. Falconer King.

Glasgow University.—Prof. J. Ferguson.

Glasgow Mechanics' Institution.—Mr. R. R. Tatlock, F.R.S.E., F.C.S.

School of Chemistry, 138, Bath Street, Glasgow.—Dr. Wallace, Mr. Tatlock, and Dr. Clark. Day and Evening Classes.

Chemical Laboratory, 144, West Regent Street, Glasgow.—Dr. Milne. Day and Evening Classes.

Analytical Laboratory, 88, Hope Street, Glasgow.—Dr. A. T. Machattie, F.C.S. Day and Evening Classes.

Queen's College, Belfast.—Dr. Andrews, F.R.S., &c.

Queen's College, Cork.—Dr. Maxwell Simpson.

Queen's College, Galway.—Dr. T. H. Rowney.

Royal College of Surgeons in Ireland.—Dr. C. A. Cameron.

University of Dublin.—Dr. J. Emerson Reynolds.

Dublin, Carmichael School.—Dr. C. R. C. Tichborne.

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 87.)

Chlorine, Bromine, Iodine, and Fluorine.
By Dr. E. Mylius, of Ludwigshafen.

When Deacon's process was first made known its industrial practicability was strongly doubted. The principal difficulties were considered to depend on the regulation of the temperature, the enormous volume of gases to be dealt with, and the considerable consumption of fuel. Since, however, the two former obstacles have been overcome by the inventor in the manner described, the process seems more and more available. In Great Britain at least 13 establishments are already working on the new process, and in Germany 2 (Kunheim and the Rhenania, the latter experimentally). According to Deacon's statement more than 1000 kilos. of chloride of lime at 35 per cent are obtained from 1500 kilos. of salt, with a consumption of 1000 kilos. small coal. A small portion of the hydrochloric acid gas is lost from causes not as yet fully ascertained, but the portion which passes undecomposed through the apparatus is entirely recovered.

Besides Deacon's process several other proposals have been made for obtaining chlorine, and in some cases without the use of manganese, but they have not been adopted in practice.

Thus Macfarlane* hoped to obtain soda and chlorine simultaneously by passing air over an ignited mixture of copperas and salt. Sulphate of soda and ferrous chloride are formed, which latter is converted into iron oxide and chlorine by the oxygen. The mixture of sulphate of soda and oxide of iron on reduction with coal and lixiviation with water yields sodium hydrate (easily convertible into soda) and iron sulphide which is reconverted into copperas on exposure to the air. Clemm† endeavoured to use chloride of magnesium for the preparation of chlorine; he mixed the magnesium chloride with manganese and decomposed it by a current of superheated steam.

Chloride of lime, the only form in which free chlorine is found in the market, has latterly been the subject of a number of published papers, which have not led to any material change in the manner of its preparation. The causes of its spontaneous decomposition, sometimes attended with explosions, and formerly not infrequent, have been investigated. To avoid such misfortunes it is recommended not to saturate the lime when too hot, and not to carry the process to the uttermost attainable point, and also not to pack it in barrels when still too recent and too moist. The gas which occasions the explosion of the chloride of lime casks has been found to be oxygen, and on such spontaneous decompositions the mass of the compound is converted into a mixture of chloride and chlorate of calcium. Interesting dissertations of a more scientific character concerning the nature of chloride of lime have been published by Kolb, Riche, Bobierre, Scheurer-Kestner, Tschigianjang, Fricke and Reimer, Crace-Calvert, and Göpner, which unfortunately cannot be reported on in brief, as the results of these researches are in part, at least, contradictory. The final solution of the question as to the constitution of chloride of lime is by no means solved.

(To be continued).

ON THE ELECTROLYSIS OF THE DERIVATIVES OF ANILINE, PHENOL, NAPHTHYLAMIN, AND ANTHRAQUINON.

By M. F. GOPPELSROEDER.

I have completed my first experiments on electrolytic aniline-black, and I am in a condition to give the numerical results of my analyses, and the rational formula to which they seem to lead. Quite differently from the salts of aniline behave the salts of crystallised toluidin and also the salts of pseudotoluidin. The former furnish at the positive pole a brown matter, soluble in alcohol and dyeing silk and wool a yellowish brown. Pseudotoluidin distinguishes itself from it very plainly, since on electrolysis we obtain at the positive pole a reaction which agrees with that which is obtained by chloride of lime. It forms a violet colour, which is changed by dilute nitric acid or by the solution of permanganate of potash to a red colour. The mixtures of the bases aniline, toluidin, and pseudotoluidin behave differently from the separate bases. Thus an aqueous solution of 1 molecule of hydrochlorate of aniline with 2 molecules of hydrochlorate of toluidin is coloured red at the positive pole. Commercial aniline imperfectly

* "Berichte über die Entwickelung der Chemischen Industrie während des Letzten Jahrzehends."

* Macfarlane, *Dingl. Pol. Journ.*, clxxii., p. 129.
† Clemm, *Dingl. Pol. Journ.*, clxxiii., p. 127.

saturated with sulphuric acid, in an aqueous solution, with an addition of ammonia, gave, at the dehydrogenising pole as a principal product, a red colour, and as a secondary product a violet colour. Methylanilin gives when employed in the form of its salts a violet colour at the positive pole. I have otherwise observed, according to circumstances, other colourations, among them a blue. Diphenylamin gives, if one of its salts is submitted to electrolysis at the positive pole, a blue product soluble in alcohol. Mixtures of diphenylamin and of ditoluylamin or of diphenylamin, ditoluylamin, and phenyltoluylamin such as are employed to produce the blue colours called *diphenylamin blue*, or, according to theory, *triphenylated rosanilin blue*, give, if submitted in the state of salt to a galvanic current, this beautiful blue colour soluble in alcohol. Methyl-diphenylamin which, as Bardy has shown, yields, with different oxidising agents a blue or violet colouring matter, undergoes the same transformation in the electrolytic way. Phenol, in an acidulated aqueous solution or in the form of phenate, gives rise at the positive pole to a brown body. The salts of naphthylamin decomposed by the current, in a neutral or acid solution, give rise to naphthylamin violet. Anthraquinon has attracted my attention. I sought first to transform it by electrolysis at a low temperature into alizarin and the latter into purpurin, but without success. I commenced then a new series of experiments, operating at a high temperature. Meeting anew with great difficulties, I obtained, however, a result which encourages me to continue my studies. I observed that on operating with caution a part of the anthraquinon is transformed into alizarin. This transformation takes place on introducing into a very concentrated solution of caustic potash anthraquinon reduced to a very fine powder, passing the galvanic current and heating almost to the melting-point of potash. The mass is coloured at first red and then violet by the formation of alizarate of potassium. But this colouration is rapidly replaced by a new red colouration, which soon changes to a yellowish brown and even to a deep brown, and consequently we obtain a violet product mixed with unchanged anthraquinon and with brown electrolytic products. If we continue to heat it the mass becomes more and more clear and finally white. If at the moment when the last red colouration presents itself we reverse the current the mass again becomes violet, then red and yellowish, because without doubt anthraquinon and even anthracen are formed again. I may say, moreover, in a general manner that if we do not go too far with decompositions, we may by reversing the poles of the battery regenerate at the new negative pole the modified bodies, and reproduce at the new positive pole the transformations that were previously produced at the opposite electrode. In the electrolysis described of the derivatives of aniline, phenol, and naphthylamin, the positive pole plays the principal part. In the electrolysis of anthraquinon it is at the negative pole that the violet colouration commences and remains most intense during the whole of the operation. All the experiments of which I have just spoken depend on the decomposition of water or an alkaline derivative by the current. It is the electrolytic oxygen which acts in dehydrogenising, or in other cases it is the oxyhydryl of the potassium or of the sodium which is substituted for the hydrogen of the chromogen.

Up to the present time I have turned my attention especially to the principal products, without losing sight of the secondary products, the study of which is necessary to arrive at a clear idea of the metamorphoses which take place. It is also necessary to observe the gaseous products. The action of the current on melted organic bodies, proceeding as we do in mineral chemistry, will present especially great difficulties, whether because heat alone decomposes them, or because the electric conductibility is too weak; but the study of these actions ought not to be neglected. We ought to try also to arrive at the simultaneous decomposition of other bodies added to the electrolyte, to arrive at substitution products of the chromogen or of its electrolytic product. We shall thus arrive at substitutions by alcoholic radicals and by the phenyl series, just as we succeed by the aid of nitric acid or nitrates in producing at the positive pole nitro-derivatives and at the negative pole nitroamido-, amido-, and even azo-derivatives. The chemistry of colouring-matters will find in the researches of which I have spoken, a field so much the more fertile as the oxidations and the dehydrogenisations play the most important part in the production of colours.—*Comptes Rendus*.

ON CERTAIN NEW SALTS OF BISMUTH, AND THEIR EMPLOYMENT IN THE DETECTION OF POTASH.

By A. CARNOT.

I have succeeded in preparing certain new salts of bismuth, which are distinguished among all the salts of the same metal with mineral acids, by complete solubility in water. These are *double hyposulphites of bismuth and alkalies*. I shall indicate the method of preparation and the properties of these salts, and shall show that they are capable of a very interesting application in analytical chemistry. If into a slightly acid solution of chloride of bismuth we pour a concentrated solution of hyposulphite of soda, the liquid immediately takes a yellow colouration; it remains otherwise perfectly clear, and it even resumes a complete limpidity if it was at first a little dull for want of acid. It may be afterwards mixed with water in any quantity without there being produced any turbidity, provided that we employ a sufficient quantity of hyposulphite (about 3 grms. to 1 of bismuth). This liquid, left to itself, changes gradually, and so much the quicker as it is more concentrated. There is a deposit of sulphide of bismuth and a formation of sulphates, a reaction which is easily explained by the decomposition of hyposulphite of bismuth—

$$Bi_2O_3,3S_2O_2+3HO=Bi_2S_2+3(SO_3,HO).$$

Heat favours this decomposition and produces a deposit of sulphide in small black crystalline grains, which, under the microscope, present a cubic form. We may add any quantity whatsoever of alcohol to the solution which has just been prepared, or pour hyposulphite of soda into an alcoholic solution of chloride of bismuth without obtaining any precipitate. But we must remark that, if alone, the hyposulphite of soda gives immediately a white precipitate in alcohol, where it is almost insoluble. The compound formed, which is a double hyposulphite of bismuth and of soda, is thus distinguished at once both from the ordinary salts of bismuth by its solubility in water and from hyposulphites by its solubility in alcohol. A small quantity of chloride of potassium added to the perfectly clear alcoholic liquid, produces immediately an abundant precipitate of a siskin yellow, which collects easily, especially after some moments agitation. There is not produced, on the contrary, any precipitate in presence of chlorides of sodium, lithium, ammonium, calcium, magnesium, aluminium, iron, manganese, &c.—in a word, all usual metals, which are not precipitated by sulphuretted hydrogen. Only the chlorides of barium and of strontium give white precipitates in an aqueous or alcoholic solution of hyposulphite. The reaction of the salt of potash is therefore quite characteristic. It has seemed to me calculated to furnish a very sensitive and very rapid process for the detection of this base, a detection which is tedious and delicate by the processes at present in use. It succeeds not only with a solution of chlorides but also with a mixture of chlorides and nitrates, and even with nitrates alone, chlorine playing no part in the formation of the precipitate. It is, on the contrary, more or less incomplete in the presence of sulphates, and doubtless cannot be applied directly for the detection of potash in this class of salts. We know, however, that it is the same with the best processes known up to the present time for the separation and the determina-

tion of this base. All require a previous transformation of sulphates.

Double Hyposulphite of Bismuth and Potash.—In view of an application of the potash compounds in analytical chemistry, I have made them the subject of a special study. Here are the principal results:—The yellow precipitate obtained in alcohol is easily soluble in water; its solution is greenish; it is, on the contrary, very insoluble in alcohol. We may then purify it from the salts which saturate it by receiving it at first on a filter, washing with alcohol, then dissolving in a little water, and precipitating anew by alcohol in excess. After one or two similar operations it may be considered as very pure. It may be then dried gently on the filter, and withstands afterwards, without change, a temperature of 100°. It keeps very well when dried, but changes rapidly if moist, notably in contact with the mother liquid, whence it has been precipitated, and which is, moreover, itself readily changeable. In these conditions, it is, at the end of some hours more or less mixed with sulphide of bismuth, which modifies the colour and composition. The neutral solution of the salt in water changes likewise and gradually deposits sulphide. The salt precipitated by alcohol presents a crystalline aspect the more decided as it is formed more slowly. I have been able to obtain it distinctly crystallised on realising by divers methods a gradual mixture of the liquids. The difficulty always rests in the want of stability of the liquor, which ought, however, to remain a very long time in action for the formation of crystals; thus we can scarcely avoid a little sulphide being mixed with the crystals of hyposulphite. The process which has given me the best results consists in making the aqueous solution of the three substances in the required proportions (about 1 part of chloride of potassium and 3 parts of hyposulphite of soda in crystals to 1 part of metallic bismuth transformed into chloride) precipitating with alcohol and filtering to remove the mother-liquor, re-dissolving in water, and adding alcohol to the solution, but without producing any turbidity; then we plunge into it a dialyser, into which we pour concentrated alcohol so as to raise gradually the alcoholic percentage of the hyposulphite solution. There is formed on the sides of the vessel, and principally under the membrane of the dialyser, yellow greenish crystals, very brilliant, presenting the form of prismatic needles, very fine in general, and from 2 to 3 millimetres in length, but attaining sometimes 10 millimetres in length and ¼ millimetre in diameter. These crystals keep very well in the air without any alteration. I have made several analyses of the crystallised salt or crystalline precipitate. They have always given me results which correspond rigorously to the formula—

$$Bi_2O_3.3S_2O_2+3(KO.S_2O_2)+2HO.$$

or in hundredths—

Hyposulphurous acid	42·25
Bismuth oxide	34·33
Potassa	20·78
Water	2·64
	100·00

It remains for me to indicate in what manner the formation of this salt may be practically utilised for the separation and the determination of potash.

THE CHEMICAL CONSTITUTION OF THE HIGHER ACID HETEROLOGUES OF THE ETHYLIC, GLYCOLIC, AND GLYOXALIC ALCOHOLS,

AS VIEWED AND INTERPRETED FROM THE STANDPOINT OF THE "TYPO-NUCLEUS" THEORY.

By OTTO RICHTER, Ph.D.

In a paper on the chemical constitution of glycolic alcohol and its heterologues, which I had the honour of reading at the meeting of the British Association in Edinburgh some years ago, I drew attention to the existence of two closely-related organic family groups, one of them having for its parent molecule the ethylic and the other the glycolic alcohol. I took also the opportunity of pointing out the natural order of succession, in which the basic and acid members of each group are descended from their respective parent alcohols, and to enlarge on the evident parallelism and intimate chemical relations subsisting between these two series of derivatives. It becomes now requisite for me to add thereto a third family group of molecules, which have for their common progenitor the glyoxalic alcohol. A simple comparison of these three systems, as placed side by side in the annexed scheme, will, I trust, enable the reader to grasp some of the chemical relations just referred to, while it will help to throw a bright and powerful light upon several obscure and disputed points, a full elucidation of which cannot fail to prove of the highest theoretical value and importance.*

Taking it for granted that, within certain limits, the formulæ embodied in the preceding scheme are well calculated to give a correct idea of the internal molecular structure and arrangement of these three sets of derivatives, I shall now, on the basis of these formulæ, proceed to analyse a number of chemical reactions which—from the more or less striking physical and chemical properties of the resulting compounds, as well as the deep mystery in which the majority of these reactions continue to be shrouded—have never ceased to be regarded with special attention and interest. In former papers on this subject (Chem. News, vol. xxviii., pp. 87 and 103) I have already had occasion to describe the molecular changes, when the higher acid heterologues of the second and third family groups make their appearance amongst the decomposition products of certain bibasic water salts. In particular I occupied myself with tracing the various movements of one of the two basic hydrogen nuclei when the tartronate—

$$\begin{matrix} H_2O_2. & H_2O_2. & H_2O_2. \\ Fo_2O_2.2C_2O_3 & - & 2C_2O_3 \end{matrix}$$

is made by heat to split up into carbonic acid and the glycolate, or when the mesoxalate—

$$\begin{matrix} H_2O_2. & H_2O_2. \\ 2C_2O_2.2C_2O_3 & - & 2C_2O_3 \end{matrix}$$

is by the same agent made to resolve itself into carbonic acid and the glyoxalate; and from these results I have been led to conclude that during the conversion of the mesoxalate into the tartronate by means of nascent hydrogen, that element must have expended its reducing energies upon the carbonous acid adjunct in preference to the more highly oxidised oxalic acid principal, a mode of viewing which is strongly supported by the fact that both the oxalate and the glyoxalate can be speedily transformed into the glycolate by means of this powerful reducing agent. It is, noteworthy, however, that on treating the latter compound with oxidising agents the resulting product is not, as might be expected, the glyoxalate, but the so-called glyoxylate, clearly showing that the two molecules of oxygen, instead of regenerating the carbonous acid adjunct with elimination of two water molecules, prefer to combine directly with the formic acid principal. If now we bring a second pair of oxygen molecules to act upon the latter compound, the resulting product is undoubtedly the oxalate, clearly showing that it is the car-

* The chemical formulæ employed are generally the double of the ordinary formulæ. The notation is simplified by means of symbols representing hydrogen or bicarbon nuclei variously modified by their chemical union with different hydrocarbon and halogen adjuncts. Strokes placed above these symbols indicate the number of substituted bromine molecules in the associated hydrocarbons. The following is a list of the symbols embodied in the formulæ of the text:—(1.) Formyl in the two isomeric modifications, $Fo_2=2C_2$; H_2 and $2Fo=2H$; $2C_2$ (bromformyl, $2\bar{F}o=2Br$; $2C_2$). (2.) Methyl, $Me_2=2H_2C_2$; H_2. (3.) Ethyl, $Et_2=2H_4C_4$; H_2. (4.) Acetyl in two isomeric modifications, $Ac_2=2H_2C_4$; H_2 and $2Ac=2H_2C_2$; $2C_2$ (bromacetyl, $2\bar{A}c=2H_2C_2Br$; $2C_2$; dibromacetyl, $2\bar{A}c=2HC_2Br_2$; $2C_2$; tribromacetyl, $2Ac=2C_2Br_3$; $2C_2$). $H_2=2$; $C_2=12$; $O_2=16$.

SYNOPTICAL ARRANGEMENT OF CHEMICAL FORMULÆ EXPRESSING THE CHEMICAL CONSTITUTION OF THREE CLOSELY-RELATED ORGANIC FAMILY GROUPS.

First Group.		Second Group.		Third Group.	
Ethylic alcohol,	$\frac{H_2O_2}{Et_2O_2}$	Glycolic alcohol,	$\frac{H_2O_2.\ H_2O_2}{Fo_2O_2, Me_2O_2}$	Glyoxalic alcohol,	$\frac{H_2O_2}{2C_2O_2, Me_2O}$
De-ethylic alcohol, (acetylic).	$\frac{H_2O_2}{Ac_2O_2}$	De-glycolic alcohol,	$\frac{H_2O_2.\ H_2O_2}{Fo_2O_2, Fo_2O_2}$	De-glyoxalic alcohol,	$\frac{H_2O_2}{2C_2O_2, Fo_2O_2}$
Acetite, (acetaldehyd).	$\frac{H_2O_2}{2AcO}$	Glycolite, (oxyacetaldehyd).	$\frac{H_2O_2.\ H_2O_2}{Fo_2O_2, 2FoO}$	Glyoxalite, (glyoxal).	$\frac{H_2O_2}{2C_2O_2, 2FoO}$
Acetate,	$\frac{H_2O_2}{2AcO_3}$	Glycolate,	$\frac{H_2O_2.\ H_2O_2}{Fo_2O_2, 2FoO_3}$	Glyoxalate,	$\frac{H_2O_2}{2C_2O_2, 2FoO_3}$
Acetoate, (oxyacetate).	$\frac{H_2O_2}{2AcO_5}$	Glycoloate, (glyoxylate).	$\frac{H_2O_2.\ H_2O_2}{Fo_2O_2, 2FoO_5}$	Glyoxaloate, (oxalate).	$\frac{H_2O_2}{2C_2O_2, 2FoO_5}$

bonous acid adjunct which has been regenerated with elimination of two water molecules. In connection with the term "glyoxylate" the reader will not fail to recall to mind a very keen and spirited controversy, regarding the true formula of that water-salt, which was inaugurated last year at one of the meetings of the London Chemical Society, where Messrs. Perkin and Debus took a very prominent part. Having carefully pondered this interesting problem from the novel and more elevated standpoint of my "Typo-nucleus" theory, I feel confident that a condensed report of the results of my speculative labours will be welcomed by many as a pleasant and profitable interlude, while fresh data are being gathered on the rich and productive soil of experimental research. I have therefore bethought myself of embodying an epitome of my researches in the present communication, and shall at once proceed to state the leading topics of my programme, which I have found it advisable to divide into two parts. In the first part I shall expound the molecular changes accompanying the substitutional action of bromine and perbromide of phosphorus on the water-salts of acetic, glycolic, glyoxylic, glyoxalic, and oxalic acids. In the second part I shall expound the molecular changes which ensue when the dry or dissolved combinations of the bromacetic, dibromacetic, and bromoglycolic acids with the alkalies, oxide of silver, and oxide of ammonium are subjected to the decomposing influence of temperature. Let us then, in the first place, inquire into the contents of the first part of my programme.

PART I.

On the Principal Molecular Changes accompanying the Substitutional Action of Bromine and Perbromide of Phosphorus on the Water-Salts of Acetic, Glycolic, Glyoxylic, Glyoxalic, and Oxalic Acids.

Commencing with the acetate, its brominated derivatives—whether obtained by the action of bromine on that compound or by the more expeditious method of employing acetic anhydride instead—are the following three :—

(1) The α bromacetate, $\frac{H_2O_2}{2AcO_3}$,

(2) The α dibromacetate, $\frac{H_2O_2}{2AcO_3}$,

And (3) The α tribromacetate, $\frac{H_2O_2}{2AcO_3}$,

but the first two derivatives are believed to be so entirely destitute of the character of stability that they are immediately made to merge into the isomeric modifications of the—

β bromacetate $= \frac{H_2O_2}{Fo_2Br_2, 2FoO_3}$,

and the β dibromacetate $= \frac{H_2O_2}{Fo_2Br_2, 2FoO_3}$,

while the third derivative, although endowed with the attribute of stability, is, under certain conditions, prone to pass into the β variety—

$$\frac{H_2O_2}{=2C_2Br_2, 2FoO_3}.$$

As regards the molecular changes attending these metamorphoses they are believed to consist, with reference to the first two derivatives, in the splitting up of the brom- or dibrommethyl adjunct into formyl-bromide, which instantly re-unites as adjunct with the residual formic or bromo-formic acid principal; but with reference to the third derivative the molecular changes are held to consist in the splitting up of the tribrommethyl adjunct into bromo-carbonous acid, $2C_2Br_2$, which, by its transition from the hydrocarbon type into the acid nucleus type, becomes now qualified to re-enter into chemical union with the residual bromo-formic acid principal. I have not as yet succeeded in gathering reliable data for studying the action of bromine on the glycolate and glyoxalate which, in theory, ought to give rise to the bromo-glycolate and bromo-glyoxalate. The first of these derivatives may, however, be got in another way,—namely, by treating the glyoxylate with perbromide of phosphorus, and decomposing the resulting bromoxyglycolyl-bromide, $Fo_2Br_2, 2FoO_4Br$, with water, where it is plain that the molecular changes must consist in the replacement by hydroxyl of that particular bromine molecule which forms a constituent element of the dioxyformyl-bromide principal; while the second may be got as an ether salt by treating the oxalate of ethyl and potassium,—

$$\frac{Et_2O_2.K_2O_2.}{2C_2O_2, 2C_2O_4},$$

(the ordinary oxalovinate of potash), with oxybromide of phosphorus, where the previously-formed glyoxalic ether bromide,—

$$\frac{Et_2O_2.}{2C_2O_2, 2C_2O_3Br},$$

may be supposed to pass more or less readily into the isomeric bromo-glyoxylate of ethyl,—

$$\frac{Et_2O_2.}{2C_2O_2, 2FoO_3}.$$

Reverting again to the above-mentioned bromoxyglycolyl-bromide, the reader will bear in mind that its formation depends upon the successive action of two molecules of perbromide of phosphorus on the glyoxalate, and, being impressed with the theoretical importance of the fact that a third molecule of perbromide is yet capable of acting substitutionally upon this derivative with production of a body which is found to be identical in all respects with the dibromoxyacetyl-bromide as obtained by the action of the perbromide on the dibromacetate, I have deemed it desirable of submitting to him a full analysis of the molecular changes which mark the various stages of the process. In taking for my guide the analo-

gous behaviour of the glycolate, when it is treated in succession with one and afterwards with another molecule of perbromide, and whereby it becomes converted first of all into oxyglycolyl-bromide,—

$$H_2O_2,$$
$$Fo_2O_2,2FoO_2Br,$$

and subsequently into bromo-glycolyl-bromide,—

$$Fo_2Br_2,2FoO_2Br,$$

I proceed upon the hypothesis that the product of the action of the first molecule of perbromide on the glyoxylate is the dioxyglycolyl-bromide, as expressed by the formula—

$$H_2O_2.$$
$$Fo_2O_2,2FoO_4Br,$$

where the molecular changes consist in the replacement by bromine of that particular hydroxyl molecule which belongs to the oxyformate of water group; again, that the product of the action of a second molecule of perbromide on the latter derivative—namely, the above-mentioned bromoxyglycolyl-bromide—is expressed by the formula $Fo_2Br_2,2FoO_4Br$, where the molecular changes consist in the replacement by bromine of that particular hydroxyl molecule which belongs to the colligated formylic alcohol group. But as regards the mode of formation of the third derivative, since, as our formula implies, there is no more hydroxyl to replace, it becomes manifest that the reaction must of necessity take a different course. This course, I venture to say, will consist in the previous conversion of the bromoxyglycolyl-bromide into the isomeric dibromacetate—

$$H_2O_2.$$
$$Fo_2Br_2,2FoO_3.$$

Thanks to this perfectly natural and intelligible metamorphosis our molecule has now put itself in possession of the much-coveted hydroxyl, so that the replacement of the latter by bromine can be accomplished without difficulty.

In reliance upon the general correctness of the foregoing, and I trust sufficiently lucid, explanations, I shall now proceed to contemplate the effects of temperature on the various brominated derivatives before us, and for that purpose direct the reader's attention to the second part of my programme.

To be continued.)

CORRESPONDENCE.

NEW PROCESS FOR THE QUALITATIVE DETECTION AND THE DETERMINATION OF POTASSA.

To the Editor of the Chemical News.

SIR,—In a paper on the above subject M. A. Carnot, in the CHEMICAL NEWS (vol. xxxiv., p. 85), describes a new method for the quantitative estimation of potassium, and towards the end of the paper he says:—

"The weight of the potassa is found on multiplying the weight of the sulphide of bismuth by—

$$\frac{3KO}{Bi_2S_3} = 0{\cdot}549.$$"

I think he must have calculated it by some new method, as it appears to me when calculated in the usual way to be—

$$\frac{3KO}{Bi_2S_3} = 0{\cdot}320.$$

—I am, &c.,

R. P. D.

September 4, 1876.

DETERMINATION OF LITHIUM BY MEANS OF THE SPECTROSCOPE.

To the Editor of the Chemical News.

SIR,—In the CHEMICAL NEWS (vol. xxxiv., p. 94) there is a short notice of a paper by M. H. Ballmann on the determidation of lithium by diluting a solution of the metal till a drop, when ignited, ceases to give the chracteristic spectrum. Two or three months ago I made a series of experiments with potassium and the alkaline earths, with the idea of estimating them in solution, by diluting till a *measured quantity*, generally 0·3 c.c., introduced into the flame, ceased to give the most characteristic line of the metal employed. I attached to platinum wires pellets of cotton-wool, or filter papers folded as if for burning, which were made to absorb the quantity of solution, then introduced into the edge of the Bunsen flame. After the drying and burning of the combustible matter, the ash, which is left in the state of a fine network impregnated thoroughly with the salt introduced, gets strongly ignited, and gives the desired spectrum. I found, however, that by diluting the spectra lost their brilliancy so imperceptibly that it was very difficult to fix the point at which they disappeared, especially so with the alkaline earths. It is possible thus to estimate the amount of potassium in a solution, the error allowed being about ten times the quantity of metal to be estimated.

I also tried diluting the solution till the line was equal in intensity to that produced by the ignition of a measured quantity of a very dilute solution of the metal of known strength, but met with no better success.

The results of these experiments, and the strain upon the eyes, produced by repeatedly looking attentively for a very faint line, or by looking for a line which you think ought to appear, induced me to give up this method of experimenting.

I would add that a filter paper (as before described) with so much solution of potassic chloride as contained 0·0000006 grm. of metal, when ignited gave the Kα line distinctly. Roscoe gives 0·00000032 grm. of potassium as the minimum observable quantity; but by the nature of his experiment that quantity was introduced every second, whereas in the other case the minute portion was introduced once for all.—I am, &c.,

HENRY C. JONES.

Highbury, September 4, 1876.

MISCELLANEOUS.

British Association for the Advancement of Science.—The meeting of the British Association for 1877 will be held at Plymouth, and will commence on the 15th August. Dr. Allen Thomson, F.R.S., has been nominated President-elect, and the Vice-Presidents chosen are the Earl of Mount Edgecumbe, the Earl of Devon, Lord Blackford, W. Spottiswoode, F.R.S., W. Froude, F.R.S., and C. Spence Bate, F.R.S. The meeting for 1878 will be held at Dublin. The following is a complete list of the papers brought before the Chemical Science Section of the Glasgow Meeting, under the Presidency of Mr. W. H. Perkin, F.R.S.; they will be published in full or in abstract, according to their importance, in the CHEMICAL NEWS:—

M. M. P. Muir, F.R.S.E.—On Essential Oil of Sage.
J. A. R. Newlands.—On Relations among the Atomic Weights of the Elements.
C. H. W. Biggs.—On a New Voltaic Battery.
J. J. Coleman.—On a Gas Condensing Machine for the Liquefaction of Gases by Combined Cold and Pressure.
W. Ramsay.—On Picoline.
J. E. Stoddart.—Lead Desilverising, by the Zinc Process.
Dr. Corfield.—Report of Sewage Committee.
A. H. Allen.—Report on Commercial Phosphates and Potash Salts.
J. Banks.—Sewage Purification and Utilisation.
J. J. Coleman.—Experimental Researches on the Chemical Treatment of Town Excreta.
Professor Gamgee.—On the Physiological Action of Pyro-, Meta-, and Ortho-phosphoric Acids.

F. H. T. Allan.—On a Safe and Rapid Evaporating Pan.
Professor Thorpe, F.R.S.—Report on Specific Volumes of Liquids.
Dr. Atkinson.—Report of Committee for the purpose of Collecting and Suggesting Subjects for Chemical Researches.
Walter Weldon.—On the Means of Suppressing Alkali Waste.
Dr. Macvicar, F.R.S.E.—On the Possible Genesis of the Chemical Elements out of a Homogeneous Cosmic Gas or Common Vapour of Matter.
J. Emerson Reynolds, M.D.—On Glucinum: its Atomic Weight and Specific Heat.
G. Johnstone Stoney, F.R.S.—On the Atomicity of Oxygen and on the Constitution of Basic Salts.
E. H. W. Biggs.—On a New Voltaic Battery.
W. H. Perkin, F.R.S.—On New Anthracen Compounds.
J. B. Brown.—On Anthracen Testing.
Professor Guthrie, F.R.S.—On Solid Water.
Dr. C. R. A. Wright.—On the Alkaloids of the Aconites. On New Cotarnine Derivatives.
C. T. Kingzett.—On the Oxidation of Terpenes. Part IV.
Professor Crum Brown.—On the Action of Pentachloride of Phosphorus on Turpentine.
A. C. Letts.—On Two New Hydrocarbons from Turpentine.
J. V. Buchanan.—On some Instruments Used in the "Challenger."
Professor Gladstone, F.R.S.—The Influence of Condition and Quantity of the Negative Element on the Action of the Copper-Zinc Couple.
W. N. Hartley.—On the Critical Point of Liquid Carbonic Acid in Minerals.
R. D. Silva.—On the Action of Hydriodic Acid on Mixed Ethers of the General Formula $C_nH_{2n+1}O.CH_3$.
Dr. Cameron.—On Ammonic Seleniocyanide.
J. A. R. Newlands.—On the Alum Process in Sugar Refining.
E. M. Dixon.—On an Apparatus for the Analysis of Impurities in the Atmosphere.
W. Henderson.—History of Copper Extraction in the Wet Way.
J. Mactear.—Soda Manufacture.
E. C. C. Stanford.—Iodine and Associated Products.
J. Dunnachie.—Fire-Brick, &c.
T. L. Patterson.—Sugar.
D. Swan.—Zinc.
J. Macrobarts.—Dynamite.
F. Ward.—On the Prevention of Fraudulent Alterations in Cheques, &c.
Anderson Smith.—On Sodium.
M. M. P. Muir.—On the Action of Dilute Saline Solutions on Lead.—On some Compounds of Bismuth.
Prof. Dewar.—Transformation of Chinoline into Aniline.
W. A. Tilden, D.Sc.—On the Nitroso Derivatives of the Terpenes.—Preliminary note on a new Isopurpurine.
W. Dittmar.—On the Proximate Analysis of Coal Gas.—Remarks on Reboul's paper on Pyro-Tartaric Acid.
W. Thomson, F.R.S.E.—On the Action of different Fatty Oils upon Copper.—On the Growth of Mildew on Grey Cloth.
A. Fergusson.—White Lead.
Col. Hope, V.C.—On the Purification of the Clyde.
W. C. Sillar.—On the Utilisation of Sewage.
Rev. R. Thomson.—The Prevention of the Pollution of Rivers.

The total number of tickets sold during the Meeting was 2731. Of these 211 were to old life members, 31 to new life members, 318 to old annual members, 208 to new annual members, 1243 to associates, 696 to ladies, and 24 to foreign members. The total amount of receipts up to Tuesday evening was £2983.

Iron and Steel Institute.—A meeting of the Iron and Steel Institute will be held at Leeds on the 19th, 20th, 21st, and 22nd inst. The following is a list of papers and subjects for discussion:—

Professor Green, "Geological Features of the neighbourhood of Leeds."
G. Dove, jun., "The North Lincolnshire Iron District."
Henry Kirk, "Some Features of Revolving Puddling Furnaces and their Products."
Bashley Britten, "Glass from Blast-Furnace Slag."
R. Howson, "On Welding Iron."
G. J. Snelus, "Further Information as to the use of Molten Iron direct from the Blast Furnace." (Discussion.)
John Jones, "Technical Education in connection with the Iron Trade."

"Chymistry" and Force.—Professor Tait, in his discourse a few nights ago upon "Force," instanced as one of the things that force cannot accomplish the inability of the *Times* to make scientific men spell "chemist" with a "y." Those who have remarked the persistency with which the *Times* adheres to "chymist," may have reflected on hearing this that forces in this respect are evenly matched, and that if the journal cannot coerce men of science, they in turn are powerless to alter the practice of the journal. Professor Tait, however, has succeeded where the combined forces of chemists and grammarians have failed. The *Times* reported his speech, and his speech would have been incomplete without his illustration. The illustration would have been fruitless unless chemist was spelt with an "e," and with an "e" accordingly the *Times* spells it, for the first time, probably, within the memory of man. It is true that the offending orthography appears within inverted commas, but the fact remains, nevertheless, that Professor Tait has developed a force to which the leading journal has succumbed. He has compelled the *Times* to spell "chymist" with an "e."—*Glasgow News.*

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Chemistry—H. E. Armstrong, Ph.D., F.R.S.

Botany—The Rev. G. Henslow, M.A. Cantab., Lecturer on Botany to the Hospital.

Zoology and Comparative Anatomy—Norman Moore, M.D. Cantab., Lecturer on Comparative Anatomy to the Hospital.

Mechanical and Natural Philosophy—W. Graham, M.A., Trin. Coll., Dub., Demonstrator of Mechanical and Natural Philosophy to the Hospital.

Fee to Students of the Hospital, £8 8s.; to others, £10 10s.; fee for any single subject, £3 3s.

The London Hospital and Medical College.

HOSPITAL STAFF.

Consulting Physician—Dr. Herbert Davies.
Consulting Surgeons—Mr. Luke, F.R.S.; Mr. Adams.; Mr. Curling, F.R.S.

PHYSICIANS.	SURGEONS.
Dr. Andrew Clark.	Mr. Hutchinson.
Dr. Ramskill.	Mr. Maunder.
Dr. Langdon Down.	Mr. Couper.
Dr. Hughlings-Jackson.	Mr. Rivington.
Dr. H. G. Sutton.	Mr. Jas. Adams.
Dr. Fenwicks.	Mr. W. Tay.
ASSISTANT-PHYSICIANS.	ASSISTANT-SURGEONS.
Dr. Woodman.	Mr. McCarthy.
Dr. Stephen Mackenzie.	Mr. Reeves.
Dr. A. E. Sansom.	
Dr. Charlewood Turner.	

Obstetric Physician—Dr. Palfrey.
Assistant-Obstetric Physician—Dr. Herman.
Surgeon-Dentist—Mr. A. W. Barrett.

LECTURERS.

Medicine—Dr. Davies and Dr. Fenwick.
Surgery—Mr. Couper.
Operative Surgery—Mr. Maunder.
Anatomy—Mr. Rivington.
Practical Anatomy—Dr. Wilson.
Physiology and Practical Histology—Mr. McCarthy.
Chemistry—Dr. C. M. Tidy.
Comparative Anatomy—Dr. Ed. B. Aveling.
Midwifery—Dr. Palfrey.
Forensic Medicine—Mr. Rodgers and Dr. Tidy.
Materia Medica—Dr. Prosser James.
Botany—Mr. Baker.
Pathology—Dr. Sutton.
Diseases of Throat—Dr. Morell Mackenzie.
Anatomy and Pathology of the Teeth—Mr. Barrett.

The next Winter Session will commence on Monday, October 2nd, when the Introductory Lecture will be given by Dr. Andrew Clark, Senior Physician to the Hospital.

The Perpetual Fee to Lectures and Hospital Practice, with two years' Practical Anatomy, is 90 guineas if paid in one sum, or 100 guineas if paid by three instalments. Special entries can be made to Lectures or Practice. The Hospital contains about 800 beds. The in-patients during 1875 were 5804, and the out-patients 40,717.

1, 2. Two Entrance Science Scholarships, value £60 and £40.
3, 4. And Two Burton Scholarships, value £30 and £20, will be offered for competition at the end of September. Entries for the above must be made on or before the 20th September.
5. A Scholarship, value £20, in Human Anatomy, for first year Students.
6. A Scholarship, value £25, in Anatomy, Physiology, and Chemistry, for first and second year students.
7. A Hospital Scholarship, value £40, for Clinical Medicine.
8. A Hospital Scholarship, value £20, for Clinical Surgery.
9. A Hospital Scholarship, value £20, for Clinical Obstetrics.

A Prize of £5 to the student who has attended most Midwifery cases during the preceding twelve months.

The Duckworth Nelson Prize, value £10, for Practical Medicine and Surgery (Biennial).

Money Prizes to the value of £60 given annually by the House Committee for zeal in Dressing Out-Patients and knowledge of Minor Surgery.

For particulars as to appointments, &c., see the Prospectus, which will be forwarded on application to the Secretary, Turner Street, Mile End, E.

Greatly increased facilities are now offered by adjacent railways and tramways for rapid transit from the neighbourhood of the Hospital to other parts of London. The East London Railway Company Station is directly opposite the Hospital. Lodgings can be obtained in healthy localities in the immediate vicinity of the Hospital, at a very reasonable charge.

St. Mary's Hospital Medical School,
OPEN SCHOLARSHIPS and EXHIBITIONS in NATURAL SCIENCE.

The Examination for 1876 will be held on Tuesday, the 3rd of October, and following days. Candidates are requested to call upon the Dean, at 49, Seymour Street, Portman Square, on the morning of Monday, October 2nd, between the hours of 10 and 1, and to bring with them the necessary certificates.

For further particulars apply to the Registrar, at the Hospital, or to

A. B. SHEPHERD, M.B., Dean of the School.

St. Mary's Hospital Medical School.
Paddington, W.

OPENING of WINTER SESSION, October 2nd, 1876.—Introductory Address by Dr. Wiltshire.

SCHOLARSHIPS in Natural Science, Classics, and Mathematics, varying in value from £120 to £20. For further particulars apply to the Dean.

A. B. SHEPHERD, M.B., Dean of the School.

Royal School of Mines. — Department of SCIENCE AND ART.

During the Twenty-sixth Session, 1876-77, which will commence on the 2nd of October, the following COURSES of LECTURES and PRACTICAL DEMONSTRATIONS will be given:—

1. Chemistry. By E. Frankland, Ph.D., F.R.S.
2. Metallurgy. By John Percy, M.D., F.R.S.
3. Natural History. By T. H. Huxley, LL.D., F.R.S.
4. Mineralogy. } By Warington W. Smyth, M.A., F.R.S., Chairman.
5. Mining. }
6. Geology. By John W. Judd.
7. Applied Mechanics. By T. M. Goodeve, M.A.
8. Physics. By Frederick Guthrie, Ph.D., F.R.S.
9. Mechanical Drawing. By Rev. J. H. Edgar, M.A.

The Lecture Fees for Students desirous of becoming Associates are £30 in one sum, on entrance, or two annual payments of £20, exclusive of the Laboratories.

Tickets to separate Courses of Lectures are issued at £3 and £4 each.

Officers in the Queen's Service, Her Majesty's Consuls, Acting Mining Agents, and Managers may obtain Tickets at reduced prices.

Science Teachers are also admitted to the Lectures at reduced fees.

For a Prospectus and information apply to the Registrar, Royal School of Mines, Jermyn Street, London, S.W.

TRENHAM REEKS, Registrar.

ROYAL VETERINARY COLLEGE.—
INCORPORATED BY ROYAL CHARTER.

WINTER SESSION, 1876-7.

The Winter Sessional Course of Instruction will commence on MONDAY, OCTOBER 2.

The chair will be taken by R. W. Gaussen, Esq., and the Introductory Address delivered by Professor Pritchard, at 1 p.m.

Lectures, Clinical and Pathological Demonstrations, and General Instruction are given on Pathology and Diseases of the Horse and other Domesticated Animals, including Epizootics, Parasites, and Parasitic Affections; also on Anatomy, Physiology, Histology, Chemistry (General and Practical), Materia Medica, Toxicology, Botany, Therapeutics and Pharmacy, Hospital Practice, Obstetrics, Operative Surgery, the Principles and Practice of Shoeing, &c.

Students are required to attend two Summer and three Winter Sessions before being eligible for examination for the diploma of the Royal College of Veterinary Surgeons.

A Scholarship of £25 per annum, tenable for two years, will be awarded at the close of the Summer Session of 1877.

Annual Exhibitions, Gold and Silver Collegiate Medals, a Cattle Pathology Silver Medal, and Certificate of Merit will also be awarded in addition to the Coleman Prize Medals. Class Prizes will be given in each division of the student's studies. Certificates of Distinction will likewise be conferred on students who pass a superior examination for the Diploma of the Royal College of Veterinary Surgeons.

Graduates who obtain Certificates of Distinction will be entitled to compete for the Prizes offered by the Royal Agricultural Society for proficiency of knowledge of the diseases affecting Cattle, Sheep, and Pigs. The Prizes consist of a Gold Medal and £20, Silver Medal and £10, and a Bronze Medal and £5.

College Entrance Fee 25 Gs., the payment of which confers the right of attendance on all the Lectures and Collegiate Instructions, with the exception of Practical Chemistry.

The Matricular Examination will be held on the 30th of September, at 10 a.m. Fee £1 1s. Candidates for the Scholarship, as well as those who select any of the voluntary subjects as an addition to the obligatory ones, are requested to inform the Principal of their intention, and to name the subjects at least a week previously to the Examination.

A Prospectus containing the Regulations of the College, and copies of the Matriculation Examination Papers set last Session will be forwarded on application.

JAMES B. SIMONDS, Principal.

August, 1876.

BERNERS COLLEGE of CHEMISTRY,—
EXPERIMENTAL MILITARY and NAVAL SCIENCES, under the direction of Professor E. V. GARDNER, F.E.S., &c., of the late Royal Polytechnic Institution and the Royal Naval College.

The Laboratory and Class Rooms are open from 11 to 5 a.m. and from 7 to 10 p.m. daily.

Especial facilities for persons preparing for Government and other examinations.

Private Pupils will find every convenience.

Analyses, Assays, and Practical Investigations connected with Patents, &c., conducted.

For prospectus, &c., apply to Prof. E. V. G., 44, Berners-street, W.

UNIVERSITY OF DURHAM COLLEGE
OF PHYSICAL SCIENCE, NEWCASTLE-ON-TYNE.

Sixth Session.

The Examinations for Admission and for Exhibitions will commence on MONDAY, the 2nd OCTOBER. Three Exhibitions of the value of £15 each will be awarded to entering students who show sufficient merit in the above Examinations. Candidates for these Exhibitions must send in their names to the Secretary on or before Saturday, the 23rd September.

Prospectus and conditions to be had on application.

THEO. WOOD BUNNING, Secretary.

THE CHEMICAL NEWS.

VOL. XXXIV. No. 878.

RESEARCHES ON THE CHEMICAL TREATMENT OF TOWN EXCRETA.*

By J. J. COLEMAN, F.C.S., Assoc. Inst. Eng. Scot.

PRESENT methods of dealing chemically with sewage resolve themselves into, first, treatment with lime; secondly, treatment with metallic oxides or salts; and, thirdly, treatment with carbon.

In reference to the lime process chemists are familiar with the literature upon the subject.

The second method, viz., the use of a metallic oxide or salt has certain advantages when the precipitant can be obtained cheaply and the sewage to be dealt with is largely contaminated with refuse from dye-works, as is the case at Leeds and Coventry. Subsulphate of alumina has been used in such cases. The third method of dealing with sewage, viz., by the agency of carbon, appears to me to be most generally useful, for whilst possessing the power of abstracting noxious matter from the sewage in at least as great a ratio as any chemical that can be used, the carbonaceous deposits are not liable to subsequent noxious decomposition, and the manurial value of the mud is not interfered with. In practice carbon is used in processes such as the A B C, where alum is an essential part of the system.

The efficiency of carbon for these purposes is doubtless dependent upon its being in a fine state of division, and in practice a cheap form of carbon, suitable for deodorising, has not been by any means easy to get. Common coke, peat charcoal, carbonised street sweepings, and, as proposed by Mr. Stanford, carbonised excreta, have been proposed or actually used, but all these forms of charcoal require expensive and cumbrous plant in the form of retorts, and condensing arrangements for vapours evolved in the distillation, and involve a large consumption of fuel for carbonisation, so that I have never known of any kind of charcoal being obtainable under at least 10s. per ton prime cost, the market price being generally from 20s. to 60s. per ton. My attention has been directed to a waste product produced largely—in fact, to the extent of 500,000 or 600,000 tons annually in Scotland alone. I mean the carbonised shale after removal from the retorts of our mineral oil works. The quantity of fixed carbon it contains ranges about 10 per cent, and its state of division no doubt is similar to that contained in bone-black, the carbon in the former case being associated with silicates of alum, lime, and magnesia, and, in the latter, with phosphates and carbonates of lime. An analysis of the mineral constituents shows the following composition, the material having been dried at 60° F.:—

Silica	46·28
Alumina	27·03
Oxide of iron	7·03
Phosphoric acid	0·43
Lime	1·41
Magnesia	1·80
Fixed carbon and water	16·24
	100·00

I have made a number of experiments as to its power of deodorising. In the month of May, 1875, I prepared several mixtures of human fæces with the material. The fresh fæces were first diluted with half their weight of urine.

A weighed portion of the mass was taken, and mixed with an equal weight of carbonised shale powder. The powerful odour of the fresh fæces was rapidly destroyed, the mixture became odourless, and I preserved samples in partially closed wide-mouthed bottles. During 10 days and at a temperature of 60° F. no fœtid or unpleasant smell was noticeable, and the mass being somewhat pasty I mixed it with more shale powder, so as to bring it to a pulverulent state suitable for sowing by hand as a manure, and the sample has been kept until this date without emitting the least smell of organic putrefaction. Subsequently to this and in the month of June, 1875, experiments were made with the object of comparing its action with that of bone and wood charcoal. The same mixture of fæces and urine was used. As the general result of these experiments it was found that whether animal charcoal or carbonised shale were used the proportion of one part of carbon to two of excrementitious matter was insufficient to prevent a slight putrefactive smell, after the lapse of two or three weeks, but that equal parts of excrementitious matter and carbon formed a permanently odourless mass, whether animal charcoal or carbonised oil shale were used. It appears therefore that for deodorising excreta carbonised oil shale requires to be used in the same proportion as excreta charcoal is recommended to be used by Mr. E. C. C. Stanford. Experiments were also made with urine alone, in the proportion of one part of carbonised shale powder to 4 of urine. The latter was gradually changed into a liquid smelling purely of ammonia and without the slightest putrefactive smell although it was kept some weeks.

In order to make experiments with sewage the City Statute Labour Trust of Glasgow supplied sewage collected from the following points:—

1. Sandyfaulds Street, Caledonia Road; 2. Duke Street; 3. Great Hamilton Street; 4. Gloucester Street; 5. Sauchiehall Street.

These samples were mixed so as to get a fair average, and coming from water-closet districts in dry weather, the smell was most offensive. It was divided into two portions. The first portion was agitated for ten minutes with finely divided bone-black in the proportion of 100 grains to the gallon, and the mixture was then thrown upon a funnel partially plugged with sponge, the liquid being collected. The second portion was agitated with a similar quantity of carbonised oil shale in the same proportion and manner. Both these filtrates came through deodorised, and have kept sweet to the present time. Examined some months afterwards after being kept in closely stoppered bottles, the unfiltered sample contained 4·210 free ammonia in 100,000 parts, and the sample, filtered through the carbonised shale, contained 0·428 free ammonia.

In regard to albuminoid ammonia the unfiltered sample contained 0·333 part and the filtered sample 0·285 part. In reference to the adaptability of the material for the dry-closet system, the ease with which it can be reduced to a soft charcoally powder is a great recommendation. Since these laboratory experiments have been made they have been confirmed by experiments on a large scale, and more particularly with the refuse from the water-closets and surgical wards of the Glasgow Royal Infirmary—the excrementitious matter from which is about as repulsive as any that can be met with. It is semi-liquid in character, and an experiment conducted by the author in conjunction with the medical superintendent proved that on mixing about 2 cwts. of this material with the same weight of the carbonised shale, it was, in the course of a few minutes, completely deodorised.

Experiments have been also made by the Sanitary Inspector of the City of Glasgow. His report to the Police Board, dated January of the present year, includes description of experiments made with about 7 tons of the ground material in three of the public privies of the city, and extending over a period of fifty-seven days.

The Sanitary Inspector fully endorsed the conclusions arrived at by the author as to the powerful deodorising

* Read before the British Association, Glasgow Meeting, Section B.

effect of the substance, and strongly recommended its regular use by the city authorities.

Glasgow public conveniences are, however, most of them on Macfarlane's water-trough system, and the difficulty of adapting self-acting mechanical arrangements to them prevented the adoption of a dry method, as also the fact that a Royal Commission on the subject of dealing with Glasgow sewage was then sitting.

In treating *sewage* with the material upward filtration might be resorted to, or the carbonised shale might be employed in constructing, upon the sandy foreshores of the river, filters to be eventually converted to soil, or the material could be used as an adjunct to earth intermittent filters, or as an ordinary filter, combined, if necessary, with depositing tanks.

Perhaps the best plan of utilising it would be the latter, the material being ground to a fine powder, and poured into the main sewer about 100 yards from the outfall, so as to establish thorough mechanical agitation; the mixture could then be allowed to deposit in tanks, and the clear overflow filtered through a filter of the same material in a coarsely powdered or crushed state.

It will be in the recollection of members of this Section that our distinguished past President, Sir John Hawkshaw, has been acting as Royal Commissioner appointed to inquire as to the purification of the River Clyde.

The report of the Royal Commissioner, which deals with the whole valley of the Clyde, recommends, however, chemical processes or irrigation for some of the smaller towns of the valley only, and goes on to express an opinion that he can see no other course in dealing with the sewage of Glasgow than running it to the sea with engineering works, estimated to cost 2½ millions sterling, and including a tunnel 30 or 40 miles long.

The Royal Commissioner, however, appears conscious himself that chemical science may eventually solve the difficulty, for towards the close of his report he remarks these engineering works would not be thrown away by improved methods of treatment at the outfall. If chemical science can suggest a means of lessening the enormous expenditure of two and a half millions Sir John appears to think necessary, I feel no doubt the Royal Commissioner would be gratified. The tunnel scheme is a suggestion: the absolute recommendations of the Royal Commissioner being statesmanlike proposals for organising a Board of Sanitary Commissioners for the Clyde Valley, with certain definite powers, leaving it with local townships to carry out any particular plan of purification that may be agreed upon and approved of by the central authority he proposes to create.

Sir John Hawkshaw, in the course of his enquiry, investigated the chemical processes in use in other towns, and discussed with much care the problem of dealing with the sewage of the second city of the Empire, which amounts in dry weather to 48,000,000 gallons daily.*

Whilst approving of dry-closet systems in regard to public works and in particular circumstances, the Royal Commissioner does not see how such a revolution can be effected in large towns as the abolition of water-closets.

After dismissing irrigation as impracticable from want of suitable land, and a strong objection to making experiments with ratepayers' money in farming, the report enters into the discussion of chemical processes *versus* gravitation to the sea.

The arguments Sir John uses, independently of any bearing they have on the author's proposals, are of interest generally in regard to the question of dealing with the sewage of any large city, and I may also add particularly to irrigationists, in respect to the dealing with the sewage mud, which it is impossible to deliver over square miles of land by the pipes employed in irrigation.

The Royal Commissioner uses these words—"By the addition of suitable deodorising and precipitating agents, such as alum, clay, lime, and charcoal, then allowing the solid matters to subside, and afterwards filtering the prepared liquid through prepared filters to be used intermittently, I believe that the whole of the sewage of the City of Glasgow might be discharged into the Clyde without causing a nuisance to the neighbourhood."

The adoption of a chemical method is condemned for the following reasons:—

(1.) It is argued that, assuming the daily flow of Glasgow sewage to be 48,000,000 gallons, the solid matters in the sewage suitable for carting would probably amount to 186,000 tons per annum.

(2.) That the lime used for precipitation would probably increase the weight of this mud to between 400,000 or 500,000 tons annually.

(3.) That on information received from Mr. J. B. Lawes and Mr. Caird, that the annual consumption of artificial manures in the United Kingdom does not exceed 800,000 tons, he does not see how Glasgow could dispose of 400,000 or 500,000 tons.

(4.) That judging from the balance-sheets of the sewage works at Leeds the cost of dealing with Glasgow sewage chemically would be £80,000 per annum.

Now in respect to the first argument. Glasgow sewage was analysed by the Rivers Pollution Commissioners under the superintendence of Dr. Frankland in 1870 ("Riv. Poll. Com.," Fourth Report, p. 26). It contains, in round numbers, 142 parts of solids per 100,000, which is equal to about 100 grs. per gallon. Again, Dr. Hofmann, in his Report on London Sewage,† estimates its average composition as 100 grs. solids per gallon. Glasgow sewage, owing to the plentiful rainfall and abundant water-supply from Loch Katrine, is weaker than that of other towns; so that it is impossible that 48,000,000 gallons per day of sewage could give more than 100,000 tons per annum of solids, supposing the effluent be discharged as pure as distilled water.

From this quantity must be deducted the soluble saline constituents, reducing it, say, four-tenths, or to 60,000 tons; and there must be added the moisture contained in artificial manures, say 25 per cent, which gives us as the probable correct figure 80,000 tons as the annual probable quantity of solids separable from Glasgow sewage in the form of manure.

That this figure is correct is confirmed by Prof Way's‡ report on the sewage of towns, which would bring out the quantity 91,000 tons. Mr. J. B. Lawes's estimates would bring out 89,000 tons according to the ratio of 2 to 3 lbs. solids per ton. Finally, the experiments of Mr. Keates§ at Crossness showed that 142 tons of prepared manure was obtained from 11,672,751 gallons of London sewage; 61 tons representing the mud precipitated from the sewage. This would indicate 80,000 tons per annum for Glasgow sewage, which I assume to be correct in place of the 186,000 tons assumed by Sir John Hawkshaw.

In regard to the next argument of the Royal Commissioner, that the solids would be more than doubled by the lime process, this is difficult to see, as lime is only added as a fraction of the solids. It may be correct as regards *carbon processes*, but even then the annual production of manure would be 160,000 to 200,000 tons instead of the 400,000 or 500,000 tons estimated by Sir John.

In reference to the third argument that the manure could not be disposed of. If sewage mud be classed with artificial manures of *several pounds value*, which appears to be what Messrs. Lawes and Caird include in their figures of 700,000 or 800,000 tons annual consumption of the United Kingdom, then I agree with the Royal Commissioner. But this is not the case. Sewage mud manure has only a few shillings value, and should be compared with city street sweepings manure, of which the City of

* Bateman and Bazalgette's "Report," 1868. Sir John Hawkshaw's "Report," 1876.

† Hofmann and Witt, "Report on London Sewage;" also "Corfield on Sewage," 179 to 184 inclusive.

‡ See "Reports of Sewage of Towns Commissioners."

§ See Mr. Keates's "Report to the Metropolitan Board of Works."

Glasgow alone dispose annually to farmers no less than 200,000 tons, at prices varying from 2s. to 2s. 6d. per ton.*

The final argument of the Royal Commissioner is that a chemical process would cost Glasgow £80,000 per year, including interest upon capital and expenses, taking the experience of Leeds as a guide. This is founded upon the assumption that the cost of the process would be the same here as at Leeds, and, secondly, that the product is unsaleable.

Judging from the experience of Leeds, the cost of chemicals required for dealing with Glasgow sewage would be 43,800 annually, equal to about 10s. per ton of sewage mud.

The substitution of the carbonised shale for the charcoal, &c., bought at Leeds would probably reduce the expenses to 5s. per ton—making the total £56,000; the total expense would then run thus—

Chemicals	£20,000 annually.
Working expenses	16,000 ,,
Interest on capital	20,000 ,,
	£56,000

Against this must be set the value of the manure. At the price of street-sweepings it would be £25,000, and at a little more than double the price would cover the costs of the process; whilst, on the other hand, the interest upon an expenditure of two and a half millions of money in engineering works would be £100,000 per annum.

Before leaving this subject it may be remarked that experiments made in the neighbourhood of the metropolis have been on such a small scale that they are utterly useless in judging of the results which could be attained with the sewage of a large city.

This is noticeable in reading reports of the costs of manipulation, and more particularly the cost of drying sewage mud. Of course, large cities like Glasgow, near extensive coal-fields, have enormous advantages in cheap coals, but the evaporation of a given amount of water when heat is properly and continuously applied is subject to definite rules, and the results I have seen in printed statements of costs show such a grave departure from the results of engineering practice, that I should feel confident of much more successful results in the intelligent management of the sewage of extensive centres of population, such as are found in this city.

REPORT ON THE LIMITED OXIDATION OF ESSENTIAL OILS, PART IV.; CONTAINING A PRELIMINARY REPORT ON THE ETHERS.†

By CHARLES T. KINGZETT, F.C.S., London and Berlin, &c.

A. Oxidation of Turpentine.—Since my last publication on terpenes and the products of their limited oxidation, I have had the opportunity of repeating the whole of my observations upon the aqueous solution that results when turpentine is oxidised by a current of air in the presence of water. This opportunity has been afforded me while experimenting upon no less than fifty gallons of turpentine; and while in no one particular have I to withdraw or alter any of my original statements, certain matters have come more strongly before my observation which are worthy of some notice. Before proceeding to summarise these it will be well to recapitulate the main products of the oxidation. My past researches, then, have established that turpentine yields when oxidised in the way I have described, peroxide of hydrogen, and camphoric acid (both of which may result from the action of water upon camphoric peroxide, $C_{10}H_{14}O_4$), acetic acid, camphor, and certain other less defined substances. The oil itself increases in specific gravity and contains after this treatment certain oxidised bodies, among which is a further quantity of this camphoric peroxide.

I have been able to indicate the rate at which this oxidation takes place, and to investigate more fully the nature and uses of the solution I have described. And in doing so I have experimented with large earthenware vessels arranged in a series like so many Wolffe's bottles, each of about 20 gallons capacity.

The oxidation proceeds very slowly at first, the rate being indicated by the estimation from hour to hour of the peroxide of hydrogen which is formed; but when once the oxidation has fairly set in, it proceeds more rapidly, with increasing production of peroxide of hydrogen and the other products, the amounts of which are simply limited by that of the turpentine itself. Now, assuming the operation to be started with a given quantity of turpentine in the presence of a given quantity of water at, we will say, 60° C., the turpentine begins slowly to oxidise and produce the bodies named, which then pass into solution, while the oil itself increases gradually in specific gravity, a phenomenon which is accompanied by a gradual rise in its boiling-point. Now, if no fresh turpentine be added to that already in operation there will come a time when the percentage of peroxide of hydrogen is at a maximum, and then if the blowing be continued after that time it slowly diminishes, in fact at about the same rate that it forms. If, on the other hand, the turpentine which is blown away as vapour be condensed and returned to the oxidiser, or what amounts to the same thing, if fresh turpentine be added the oxidation proceeds as rapidly as ever, while there is no limit to the amount of peroxide of hydrogen which is formed.

It is remarkable that turpentine in the act of being oxidised is capable of imparting to fresh turpentine the same and equal facility to absorb oxygen.

The slow rate at which the oxidation of fresh turpentine proceeds, and the greater rate attained after the molecules have undergone the change which induces a rapid oxidation is seen by the following figures which relate to an experiment conducted on some gallons of turpentine and water

	Grms. of H_2O_2 in 100 c.c. Solution.
After 37 hours	0·0651 grammes H_2O_2
,, 41 ,,	0·2000 ,, ,,
,, 54 ,,	0·3000 ,, ,,
,, 58 ,,	0·4500 ,, ,,

The increase that takes place in the specific gravity of the oil of turpentine as the oxidation proceeds is exemplified by the following figures which relate to another experiment:—

	0·864 originally
After 24 hours the sp. gr. of the oil	=0·880
,, 28 ,, ,, ,,	=0·881
,, 32 ,, ,, ,,	=0·888
,, 44 ,, ,, ,,	=0·949
Again—	
After 16 ,, ,, ,,	=0·8886
,, 20 ,, ,, ,,	=0·8996
,, 26 ,, ,, ,,	=0·9060
,, 39 ,, ,, ,,	=0·9136
,, 46 ,, ,, ,,	=0·9366
,, 48 ,, ,, ,,	=0·9476

The increase in the boiling-point of the oil as the oxidation proceeds is illustrated by the following determinations, which relate also to a different experiment.

The turpentine used in this experiment boiled as indicated in column (1).

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* "Reports of the Cleansing Committee of the Police Board of Glasgow."

† Read before the British Association (Section B.), Glasgow Meeting.

(1.) Original Oil.	(2.) Oil after 24 hours' Oxidation.	(3.) After 27 hours' Oxidation.
10 p. c. over at 157° C.	162° C.	165° C.
20 ,, ,, 159	165·5°	166
30 ,, ,, 160	168	170
40 ,, ,, 160	171	171
50 ,, ,, 160·5	174	174
60 ,, ,, 161	181	185
70 ,, ,, 162	193	206
80 ,, ,, 164	210	—
90 ,, ,, 166	—	—

In regard to these boiling-point determinations I should remark that in each case 100 c.c. were subjected to distillation in the way that is usual in these matters, and the temperature recorded after each 10 c.c. was collected. It is necessary also to point out that the oil, although it has been oxidised in the presence of water, is yet so full of the organic peroxide I have discovered and described in my previous researches, that when it has once reached a temperature of 160° C or less, a violent effervescence sets in from the escape of oxygen, and much heat is eliminated, as indicated by the rise in the thermometer after the lamp has been removed. I shall conclude this part of my paper by stating that having been led by the value of the solution as an antiseptic and disinfectant to attempt the manufacture of it and the residual oil I have described, on a commercial scale, I have devoted a great deal of time to the study of those conditions which are calculated to lead to the most desirable results. In this attempt I have received much help from Mr. J. Brown, F.C.S., which I have the pleasure to acknowledge. For I have been so far successful as to obtain under certain conditions readily from an inconsiderable amount of turpentine, water, and air a solution containing such large quantities of peroxide of hydrogen and the other substances above named, as to qualify it for purposes and uses upon which I propose to dwell in Section B of my report. I find that a solution containing so much peroxide of hydrogen as to be capable of evolving from 1 litre either 1531 c.c. oxygen or 3062 c.c. oxygen, according as one or both molecules of oxygen (in H_2O_2) are affected, has all the properties which I propose to describe; but before doing this I must add that these properties are far from being entirely dependent upon the peroxide of hydrogen contained. They are related also to the camphoric acid and other constituents, for they are not seriously impaired by the total destruction of the peroxide of hydrogen. This I have substantiated in an experimental way, and shall now proceed to describe the experiments themselves. These I shall only preface by stating that a solution which contains 323 grains of peroxide of hydrogen to the gallon also contains 367 grains of camphoric and acetic acids. But the percentage of each constituent and the strength of the whole mixture are matters to a great extent under control in the method of preparation.

B. Antiseptic and Disinfecting Powers of the Solution.—In studying the properties of the solution I have described I discovered that it possessed great power as an antiseptic and disinfectant, and I was led to investigate this matter somewhat fully, also to enquire into similar properties possessed by the known constituents of my solution, and in comparison with those of salicylic acid.

In the experiments given at foot of page the solution employed was of that general strength I have indicated above, and contained 2·5 grms. H_2O_2 per litre. All these experiments were made during October and November, 1875.

Those now to be given were made during June, July, and August, 1876. The antiseptic solution employed was not so strong as that used above.

	With 3½ c.c. Antiseptic = 10 per cent	With 1·75 c.c. Antiseptic = 5 per cent.	With 4 c.c. neutral Antiseptic = 11 per cent
White of egg, 35 c.c. in each case.	Kept fresh for 35 days, then mould appeared. No stink.	Fresh for 21 days, then mould appeared. No smell.	Fresh for 35 days, then mould appeared. No smell.

The only other alteration in each case was a slight darkening to brown in the colour of the albumin. But after each experiment the albumin had still its coagulable character and was not otherwise changed.

After dipping in the same solution, brain matter also kept fresh for several days, whereas without such treatment, it stunk on the next day.

Milk was also preserved for a much longer period than without, but not for so long a period as in the winter months.

Beer was also thoroughly preserved for a number of days, as long as observed; so also was blood serum. Stinking water recovered and remained good with it for months.

In conclusion I would only add that I have never examined seriously the influence of less percentages than those detailed, but there can be no doubt that much less quantities could be used in many cases with the same effects as those described. In fact this would be necessary with articles of food on account of the aromatic odour and peculiar taste of the solution.

(To be continued).

Article Experimented upon.	Antiseptics Used.	Result.	With equal vols. of water and no antiseptic.
Egg albumen, 50 c.c. containing 10 c.c. white of egg in each case.	5 c.c. neutralised by soda = 10 per cent.	Observed 24 days still fresh as at first.	Began to stink on 2nd day after.
Must from muscatel grapes, 50 c.c. taken in each experiment.	10 c.c. neutral antiseptic = 20 per cent.	No fermentation, even after days.	Soon fermented at 40° C., giv. alcohol.
Milk. 200 c.c. in each case.	10 c.c. neutral antiseptic = 5 per cent.	Faintly acid on 5th day after, solid on 7th day.	Solid and sour on 3rd day after,
Urine, 60 c.c. in each case.	10 c.c. antiseptic = 16 per cent.	Unchanged after 7 days, no longer observed.	Bad smell 2nd day, stunk on 3rd day.
Brain matter, 10 grms. in each case.	10 c.c. antiseptic.	Kept fresh 15 days, no longer observed.	Stunk on 3rd day after.
Milk, 100 c.c. in each case.	10 c.c. antiseptic = 10 per cent.	Liquid, and sweet for 9 days.	Sour and solid on the 2nd day after.
Flour paste, 100 c.c. in each case.	10 c.c. antiseptic = 10 per cent.	Fresh after 19 days, no longer observed.	Stunk on the 3rd day.
Milk, 160 c.c. in each case.	10 c.c. antiseptic = 6 per cent.	Solid and sour after 7 days.	Bad on the 2nd day, very bad on 3d day.
Bitter Beer, 160 c.c. in each case.	10 c.c. antiseptic = 6 per cent.	Still good and unchanged on 7th day, no longer tested.	Thin films on 2d day, fungus over surface on 3rd day.

THE CHEMICAL CONSTITUTION OF THE HIGHER ACID HETEROLOGUES OF THE ETHYLIC, GLYCOLIC, AND GLYOXALIC ALCOHOLS,

AS VIEWED AND INTERPRETED FROM THE STANDPOINT OF THE "TYPO-NUCLEUS" THEORY.

(Concluded from p. 122.)

By OTTO RICHTER, Ph.D.

PART II.

On the Principal Molecular Changes which ensue when the Dry or Dissolved Combinations of the Bromacetic, Dibromacetic, and Bromo-glycolic Acids, with the Alkalies, Oxide of Silver, or Oxide of Ammonium, are subjected to the Decomposing Influence of Temperature.

When the dry bromacetates of potassium, silver, or ammonium are heated up to a certain point they are found to yield the bromides of these metals along with glycolide, to which I ascribe the formula—

$$\begin{matrix} H_2O_2. \\ Fo_2O_2,2C_2O_2, \end{matrix}$$

a formula which must not be confounded with that of the someric glyoxal,—

$$\begin{matrix} H_2O_2. \\ 2C_2O_2,2FoO. \end{matrix}$$

The formation of this body is due to the splitting up of these bromacetates into the hydrates of their respective bases, and the subsequent transposition of the latter with the colligated formyl-chloride of the residual oxybromaceten, Fo_2Br_2,C_2O_2. When heated in the presence of water the aforesaid bromacetates will again produce the metallic bromides, but instead of glycolide we shall now obtain the water-salt of glycolic acid. Let us, in the next place, contemplate the effects of heat upon dry ammonium bromacetate in the presence of ammonia. The chief products of this reaction are found to be ammonium bromide and β glycolamide or glycocoll, to which I assign the formula—

$$\begin{matrix} H_2O_2.\ H_2O_2. \\ Fo_2O_2,2C_2O - 2H_2N_2, \end{matrix}$$

which implies that, in harmony with established facts, this body is endowed with the twofold character and functions of a feeble organic base and a feeble organic acid. In this metamorphosis we have again, in the first stage, the formation of ammonium bromide and glycolide; but as regards the precise nature of the molecular changes attending the second stage of the process, and which are due to the substitutional action of ammonia on the newly formed glycolide, I am obliged to reserve my explanations for another opportunity. The same remark applies also to the α glycolamide,—

$$\begin{matrix} H_2O_2. \\ Fo_2O_2,2FoO_2 - 2H_2N_2, \end{matrix}$$

which derives its origin from the substitutional action of ammonia on the water-salt of glycolic acid.

Let us now proceed to consider the effects of temperature upon the metallic dibromacetates. According to Mr. Perkin, when dibromacetate of silver is strongly heated it splits up into silver bromide and an insoluble powder, which is evidently bromo-glycolide,—

$$Fo_2Br_2,2C_2O_4.$$

When the dry bromo-glycolate of sodium—obtained by treating the bromo-glycolide with hydrate of sodium—is strongly heated in its turn, and the contents of the retort brought into contact with water, the sodium bromide is dissolved out, while glyoxylide,—

$$\begin{matrix} H_2O_2. \\ Fo_2O_2,2C_2O_4, \end{matrix}$$

remains behind in the form of an insoluble amorphous white powder. From this the ammonium glyoxylate may be readily obtained by treatment with aqueous ammonia. Now, it is stated by Mr. Perkin that when this ammonium-salt is evaporated *in vacuo*, the solution, although neutral at first, always becomes acid, and that without loss of ammonia, and ultimately yields a crystalline product having the same outward appearance and empirical formula as the *soi-disant* ammonium glyoxylate which Dr. Debus professes to have got by similar treatment, and an aqueous solution of which, he assures us, gave all the reactions of a genuine ammonium-salt. Mr. Perkin, on the other hand, was not slow in drawing attention to the fact that his crystalline powder, which I take to be α glyoxylamide with the formula—

$$\begin{matrix} H_2O_2. \\ Fo_2O_2,2FoO_4 - 2H_2N_2 \end{matrix}$$

was very prone to assimilate water with reproduction of the original ammonium-salt,—a circumstance quite in keeping with his view of the matter. In weighing the arguments brought forward by these two distinguished London chemists, I cannot help believing in the identity of the crystalline powders obtained by Mr. Perkin and Dr. Debus, and that they possess the chemical constitution which my formula attributes to them. As regards the unexpected manifestations of acidity, &c., during the process of evaporation, I may remark that a similar phenomenon was noticed by Mr. Perkin in another experiment, with this material difference, however, that the change in question was superinduced not by the abstraction of the aqueous solvent, but, on the contrary, by its addition. In the words of Mr. Perkin, "When bromoglycolate of silver was heated with a large excess of absolute alcohol in a sealed tube, the latter, after several hours' heating, was found to contain a clear liquid and a bright yellow powder. The liquid proved to be totally neutral to test-paper, which in contact with a drop of water began to turn red, plainly proving that the newly-formed glyoxylic ether was undergoing decomposition." As I intend reverting again to these remarkable manifestations, I shall proceed to describe the molecular changes when glyoxalate of water is heated with absolute alcohol to 120°. The resulting product is designated by the author as the diethyl-glyoxylate of ethyl, but if my mode of reasoning is correct its proper name will be the ethyl-glyoxylate of diethyl, with the formula—

$$\begin{matrix} Et_2O_2.\ 2(Et_2O_2). \\ Fo_2O_2,\ 2C_2O_4. \end{matrix}$$

By this formula the compound before us is shown to be a triatomic ether-salt of glyoxylic acid, in which the acid principal is no longer the monobasic oxyformic acid, $2H;2C_2O_5$, as it exists in the water-salt, but the bibasic carbonic acid, capable of saturating two molecules of ether base. Let us now imagine the replacement of one of these two ether molecules by the molecule of basic water which is engendered during the conversion of the aforesaid oxyformic into carbonic acid, and it becomes evident that the resulting compound, which I hold to be identical with the well-known carbovinate of water,—

$$\begin{matrix} H_2O_2.\ H_2O_2. \\ 2C_2O_4, \end{matrix}$$

ought to betray, as it does in fact, a distinctly acid reaction.

The preceding remarks will, I think, enable the reader to decipher the whole process of etherification as it stands with regard to the glyoxylate, where three molecules of ethylic alcohol are successively drawn into the sphere of chemical reaction. We have already seen that the action of alcohol on bromo-glycolate of silver gives rise to the neutral monobasic glyoxylate of ethyl,—

$$\begin{matrix} H_2O_2.\ Et_2O_2. \\ Fo_2O_2,2FoO_3, \end{matrix}$$

and there is nothing to hinder us from assuming that the same compound is engendered by the action of the first molecule of alcohol on the glyoxylate, while two molecules of water are eliminated. The ether being now in the presence of that element, which is capable of provoking the series of molecular changes I have already indicated, is speedily made to pass into the isomeric modification of the acid bibasic glyoxylate of ethyl,—

$$H_2O_2.\ Et_2O_2.\ H_2O_2.$$
$$Fo_2O_2,2C_2O_4,$$

which, with a second molecule of alcohol, may lead to the formation of the neutral glyoxylate of diethyl,—

$$H_2O_2.\ 2(Et_2O_2).$$
$$Fo_2O_2,2C_2O_4,$$

or else the acid ethyl-glyoxylate of ethyl,—

$$Et_2O_2.\ Et_2O_2.\ H_2O_2.$$
$$Fo_2O_2,2C_2O_4,$$

or, finally, the neutral ethyl-glyoxylate of ethyl,—

$$Et_2O_2.\ Et_2O_2.$$
$$Fo_2O_2,2FoO_5,$$

but, whichever way we take it, it becomes certain that the end product of this lengthy and complicated reaction must be the triatomic ethyl-glyoxylate of diethyl, as formulated above.

From the preceding explanations the reader will no longer be at a loss to comprehend the true cause of the hitherto unaccountable appearance of acidity on the part of the ammonium glyoxylate while it is being evaporated, —a discrepancy which Mr. Perkin would fain attribute to a want of stability and to its not possessing the character of a true salt, but which is really due to the different positions a particular molecule of hydrogen is destined to occupy in the system, and to the different duties and functions it is thereby made to discharge. Accordingly the neutral or α modification will require to be represented by the formula—

$$H_2O_2.\ Am_2O_2.$$
$$Fo_2O_2,2FoO_5,$$

and the acid or β modification by the formula—

$$H_2O_2.\ Am_2O_2.\ H_2O_2.$$
$$Fo_2O_2,2C_2O_4,$$

and the same constitutional differences will be traceable in their respective amides, the α glyoxylamide being expressed by the formula—

$$H_2O_2.$$
$$Fo_2O_2,2FoO_4 - 2H_2N_2,$$

and the β glyoxylamide by the formula—

$$H_2O_2.\ H_2O_2.$$
$$Fo_2O_2,2C_2O_3 - 2H_2N_2.$$

Finally, as regards the third isomeride of this group, viz., the ammonium glyoxylate, with the formula—

$$Am_2O_2.$$
$$2C_2O_2,2FoO_3,$$

and which at all events must be regarded as a true ammonium-salt, I can only regret that this interesting compound has not yet received that amount of attention which it assuredly deserves.

In drawing to a close, I may yet be permitted to express an anxious hope that our leading experimentalists may soon condescend to re-investigate this and other kindred problems on the principles and in the spirit of my "Typo-Nucleus" theory,—a task for which these gentlemen are so well qualified, not only in virtue of their superior talents and their exalted professional position, but more particularly on account of the rare practical tact and experience which enables them to cope with the many difficulties that are sure to be encountered in this department of organic chemistry.

Errata.—P. 121, line 10 from bottom, *for* "glyoxalate" *read* "glyoxylate." Line 14 from bottom, *for* "bromoglyoxylate" *read* "bromoglyoxalate."

PROF. DITTMAR AND THE "ANALYST."

Perhaps some of our readers may have seen in the official organ of the Society of Public Analysts, along with other startling matter, a report of the prosecution of a certain Mr. McKinnon, of Glasgow, for selling adulterated butter, and a leading article commenting in very severe terms upon the evidence of Prof. Dittmar, who was a witness on the trial. This gentleman is made to say that "he did not think Muter's system was the correct one, and was of opinion that the butter was quite sound." From a letter sent by Prof. Dittmar to the *Glasgow Herald* the report in the *Analyst* seems by no means accurate. He did not pronounce the butter "quite sound," but declared that it was "more likely than not to be contaminated with foreign fat," though he did not feel free to swear to the presence of this impurity. He did not, from any evidence to which we have access, "deliberately prefer old and worthless methods," but merely expressed a doubt—not, in our humble opinion, quite unpardonable—whether the method of Dr. Muter had as yet been verified by a sufficiently wide experience. In short, it would appear that our contemporary's report goes beyond the facts of the case, and that his leading article goes no less decidedly beyond the report.

We know that there are in connection with the *Analyst* chemists of well-earned reputation, equally anxious for the advance of their science and for the elevation of their profession. To these gentlemen at any rate, if not to the writer of the article in question, we would, in all courtesy, suggest that such attacks as that in the last number of the *Analyst* merely strengthen the hands of the common enemy—those, namely, who consider chemical analysis as altogether untrustworthy, and who regard chemists themselves as either "imbecile," "incompetent," or even as "impostors."

ENAMELLED COOKING VESSELS.

At the country meeting of the Society of Public Analysts held in Glasgow, during the recent visit of the British Association, a paper was read by Mr. Robert R. Tatlock, F.R.S.E., F.C.S., Glasgow, on "Enamelled Cooking Vessels." He stated that in some instances the milk-white porcelainous enamel, with which cast-iron cooking vessels are now so commonly prepared, is of such a character as to be objectionable in the highest degree on account of the easy action upon it of acid fruits, common salt, and other ordinary dietetic substances, by means of which lead and even arsenic are dissolved out in large quantity during cooking operations. The following analyses were given of three enamels, the samples having been taken from three cast-iron pots made by different manufacturers:—

	No. 1. Per cent.	No. 2. Per cent.	No. 3. Per cent.
Silica	61·00	42·40	42·00
Alumina	8·00	2·88	6·06
Oxide of iron	1·10	2·04	4·04
Lime	3·02	0·16	0·78
Magnesia	0·28	0·10	0·21
Oxide of lead	absent	25·89	18·48
Potash	5·61	7·99	6·46
Soda	20 67	14·67	19·25
Phosphoric acid	trace	trace	trace
Arsenious acid	0·02	0·42	1·02
Carbonic acid	0·30	absent	absent
Borax	absent	3·45	1·70
	100·00	100·00	100·00
Total bases	38·58	53·73	55·28

The author shewed that it was not so much on account of the presence of large proportions of lead and arsenic that the enamels are so objectionable, but because they are so highly basic in their character that they are readily acted upon by feebly acid solutions, the lead and arsenic being thereby easily dissolved out. He showed that the ratio of the bases to the silica in the No. 1 was as 1 to 1·58; in the No. 2 as 1 to 0·79; and in the No. 3 as 1 to 0·76. A 1 per cent solution of citric acid boiled in the No. 1 did not affect it in the slightest, while in the case of the No. 3 the glassy surface of the enamel was at once roughened and destroyed, and lead dissolved out to such an extent as to give immediately a dense black precipitate with sulphuretted hydrogen. He thought that no enamel should be admitted to use unless it was totally unaffected by boiling with a 1 per cent solution of citric acid, which was a very moderate test, and gave it as his opinion that either the use of such poisonous ingredients as lead and arsenic in large quantity should be entirely discontinued, or that the composition otherwise should be of such a character as to ensure that none of the poisonous substances could be dissolved out in the circumstances under which the vessels are used.

ON

ANTHRAPURPURIN AND FLAVO-PURPURIN.

By E. SCHUNCK F.R.S., and H. RŒMER.

In a former communication we described certain substitution-products of isoanthraflavic acid and anthraflavic acid, to show the difference of these two bodies also in their derivatives. We now describe certain experiments made to ascertain the part which these substances play in the manufacture of alizarin. We may ask how they are formed; whether they pass into alizarin on prolonged reaction with alkali; or, as seems most probable, whether they yield oxidation-products, and consequently purpurins?

We have ascertained that each of the acids yields a purpurin, isoanthraflavic acid forming the anthrapurpurin described by Perkin and anthraflavic acid—a new compound, which we have provisionally named flavopurpurin. The statement of one of us that anthraflavic acid is converted into alizarin on fusion with alkali must therefore be corrected.*

Action of Hydrate of Potassa upon Isoanthraflavic Acid.—If the aqueous solution of the potassic salt of this acid is heated with caustic potassa the originally red colour passes gradually into a violet, and particularly quickly when the temperature approaches the melting-point of potassa. When the intensity of the violet no longer increases the operation is interrupted, the melt dissolved in water and supersaturated with hydrochloric acid. A yellow gelatinous precipitate falls, which is treated with cold baryta water to remove some undecomposed isoanthraflavic acid. The residual lake, on decomposition with hydrochloric acid, yields pure anthrapurpurin, which can be readily obtained in long orange needles by crystallisation from alcohol.

That we have here a trioxyanthraquinon appears from the following analyses:—

	Found.	Calculated for $C_{14}H_5(OH)_3$.
C	65·31	65·62
H	3·28	3·12

The properties are essentially as stated by Perkin.† We shall describe them more fully below, in contrast with those of the new purpurin.

The melting-process works very smoothly, almost the theoretical yield of anthrapurpurin being obtained.

* E. Schunck, *Proc. Lit. and Phil. Soc. Manchester*, 1871, 133.
† Perkin, *Journ. Chem. Soc.*, Ser. II., vol. xi., p. 425.

Action of Hydrate of Potassa on Anthraflavic Acid.—This acid is less readily attacked by potassa than the isoacid, and there ensues partial carbonisation. This may be avoided by using a strong potassic-lye under pressure, instead of melting, and consequently employing a lower temperature.

The undecomposed anthraflavic acid is removed by boiling with baryta-water. The flavo-purpurin formed is readily soluble in alcohol, and crystallises in gold-coloured needles.

Analysis shows its composition as $C_{14}H_8O_5$.

	Obtained.	Calculated for $C_{14}H_8O_5$.
C	65·35	65·62
H	3·33	3·12

Properties of

Anthrapurpurin.	*Flavo-purpurin.*
Orange needles. Anhydrous.	Gold-coloured needles. Anhydrous.
Readily soluble in boiling alcohol.	Readily soluble in cold alcohol.
Sparingly soluble in boiling water.	Sparingly soluble.
Solution becomes red on prolonged boiling.	Solution remains yellow.
Sparingly soluble in ether.	Ditto.
Soluble in boiling glacial acetic acid, and crystallises on cooling in stellar groups of needles.	Ditto.
Soluble in concentrated sulphuric acid with a red-violet colour.	Soluble in concentrated sulphuric acid with a reddish brown colour.
Soluble in potassa-lye with a violet colour. The tone is redder than that of a solution of alizarin.	Soluble in potassa-lye with a purple colour redder than anthrapurpurin, but not so red as purpurin. On dilution or addition of alkali but slightly diluted the colour appears of a pure red. The colour disappears on standing.
Sparingly soluble in hot baryta water with a violet colour.	Sparingly soluble in hot baryta water with a red-violet colour.
The solution shows absorption-bands.	Absorption-bands in a deep stratum.
Soluble in ammonia with a violet colour. Solution shows small bands.	Soluble in ammonia with a yellowish red colour. Solution shows no bands.
Soluble in sodium carbonate with a violet colour.	Soluble in sodium carbonate with a yellowish red colour.
Alcoholic lead acetate gives a purple precipitate which dissolves with a violet colour on boiling with excess of the precipitant.	Alcoholic lead acetate gives a red-brown precipitate, very sparingly soluble in excess with a red colour.
Alcoholic copper acetate gives a fine violet solution.	Alcoholic copper acetate gives a red solution.
Sparingly soluble in alum.	Ditto.
Melting-point above 330°.	Ditto.
Sublimes in orange needles.	Sublimes in long needles resembling alizarin.
Dyes with mordants.	Ditto.
Alkaline solution gives two absorption-bands having the same position as those of alizarin.	Alkaline solution shows also two bands, but more remote from the red, and also a broad stripe in the blue.

To ascertain whether the above-described reactions might not be modified by small quantities of impurities, we converted both the purpurins into acetyl compounds, re-crystallised them until the melting-point became con-

stant, and regenerated the purpurins by means of alcoholic potassa. The reactions remained unaltered.

The identity of the purpurin obtained from isoanthraflavic acid with Perkin's anthrapurpurin we have already established by a comparison of the acetyl-compounds. They have the same properties and the same melting-point.

A determination of the atomic weight gave the following figure:—

Obtained 66·80 per cent anthrapurpurin.

The decomposition of triacetyl-purpurin according to the following equation—

$$C_{14}H_5(C_2H_3O)_3O_5+3H_2O=C_{14}H_8O_5+3C_2H_4O_2$$

would yield anthrapurpurin = 67·01 per cent. Perkin's conjecture that anthrapurpurin might be formed from isoanthraflavic acid is therefore demonstrated.

Flavo-purpurin is the fourth purpurin known, and is very readily distinguished from the rest by its spectrum.

As to the origin of isoanthraflavic acid and anthraflavic acid, we owe its explanation to a private communication from Herr Caro, of Mannheim, according to which these two bioxyanthraquinons are formed from two distinct bisulphanthraquinonic acids, by the moderated action of alkali. A more powerful action yields respectively anthrapurpurin and flavo-purpurin. Herr Caro has sent us a small specimen of both these sulpho-acids, and we were able to satisfy ourselves that the reaction passes through the following stages exactly according to his description:—

α. Bisulphanthraquinonic acid.
Anthraflavic acid.
Flavo-purpurin.

And on the other hand—

β. Bisulphanthraquinonic acid.
Isoanthraflavic acid.
Anthrapurpurin.

The authors purpose pursuing the subject further.—*Berichte der Deutschen Chemischen Gesellschaft.*

CORRESPONDENCE.

ON THE PRESENCE OF ARSENIC IN THE VAPOURS OF BONE MANURE.

To the Editor of the Chemical News.

SIR,—In a recent number of the CHEMICAL NEWS (vol. xxxiv., p. 68) I observed a review of Dr. Adam's paper on the above subject, and I take this opportunity of briefly alluding to one or two points.

Your reviewer's comments on the mutual decomposition of chloride and fluoride of arsenic, &c., by sulphuretted hydrogen, when these compounds are brought together in the gaseous state, have already been disposed of by Dr. Hurter in his able letter in the CHEMICAL NEWS (vol. xxxiv., p. 81), and no further remarks on this point are necessary. For what reason your reviewer should, however, speak of the amount of arsenic evolved in the experiments detailed as being *assumed*, and then go on to suggest the possible presence of that element in the *reagents* employed, is a question which has puzzled me considerably. As regards the incrustation found on the walls of the works referred to in the paper, the amount of arsenic found by two chemists (Prof. E. J. Mills and Mr. "M") is precisely stated, and there is no *assumption* whatever. The figures given are the result of careful analyses. The *quantities* of arsenic obtained by Prof. Dittmar and myself, in the distillates from mixtures of bones, coprolites, and arsenical acid (the experiments being in imitation of the manufacturing process), do not represent the *total* amount of that element evolved in the process. Owing to the difficulty of completely condensing the vapours, a portion of the arsenic must necessarily have escaped. But they *do* represent the amount found by us in the distillates, and the only assumption in this case is that the amount actually volatilised must have been in *excess* of that obtained. I was always under the impression that in examinations for arsenic *chemists* paid special attention to the purity of the reagents employed, but I infer from the remarks of your reviewer that such is not the case.—I am, &c.,

JAMES M. MILNE.

Chemical Laboratory,
144, West Regent Street, Glasgow.

[The friends of Dr. Adams appear somewhat sore that his charges against manure works are not at once admitted without further enquiry. The experiments of Dr. Hurter certainly seems to show that sulphuretted hydrogen does not react upon chloride of arsenic in *dry* air, whatever may be the exact relevancy of this important fact. Concerning ammonium sulphide, which Dr. Adams seems to include among the emanations of manure works, no objection has been raised. As to organic miasms, Dr. Hurter's letter supplies not a particle of evidence for doubting their incompatibility with an atmosphere charged with chloride of arsenic, fluorine, &c. As to the main point, the writer of the above letter *even yet* does not state whether the precaution of making "blank experiments" was taken. Surely when such a grave charge is brought against an important manufacture, the public, and especially the interest attacked, have a right to know, not what is usually done by "*chemists*," but what was actually done in this particular case. An author who goes so far as to include carbonic acid amongst the deleterious products of a manufacture has no reason to feel surprised if his statements are jealously scrutinised.—*Ed.* C. N.]

THERMOCHROMATISM.

To the Editor of the Chemical News.

SIR,—Major Ross, the author of "Pyrology, or Fire Chemistry," is evidently labouring under a mistake when he states in his article on "Thermochromatism, or Heat Colouration" (CHEMICAL NEWS, vol. xxxiv., p. 108), "Mr. Valentin informed me that Mr. Ackroyd was examining my 'ingenious' hypothesis published in that work." And again, on page 109, "Although Mr. Ackroyd has not made the faintest reference to the article on colour in my published work above mentioned, which, *according to Mr. Valentin*, led to his investigations," &c.

When Major Ross called at the Laboratory in December last, I introduced him to Mr. Ackroyd, who had then, for some months past, been working on colour changes, and had prepared a paper, which he shortly after submitted to the Chemical Society.

I could not possibly have used the words which Major Ross puts into my mouth for the simple reason that neither I nor Mr. Ackroyd had seen what Major Ross is pleased to make me speak of as his "ingenious" hypothesis. For the same reason Major Ross must labour under an erroneous impression when he makes me say, that the article on colour in his "Pyrology" led to Mr. Ackroyd's investigation.—I am, &c.,

WM. VALENTIN.

126, Lancaster Road, Notting Hill, W.

DETERMINATION OF GOLD IN IRON PYRITES.

To the Editor of the Chemical News.

SIR,—Seeing an article by M. H. Schwarz (CHEMICAL NEWS, vol. xxxiv., p. 94) I should be happy if you would allow me to put forward the following suggestions: After obtaining the mineral that has been fused with the iron turnings, and treating it with dilute sulphuric acid, place it then—after it has been carefully dried—in a crucible (Cornish), with 1½ ladles of pure litharge, 1 ladle of soda-ash and ½ a ladle of nitre; then mix these fluxes togethe

within the crucible, and add ½ a ladle of litharge over the whole surface, covering the whole with 1 of dry powdered borax and 1½ ladles common salt. The pot is now placed among the glowing cokes of a Cornish wind-furnace, and carefully allowed to fuse; and when the slag has the bright red wavy fluid appearance, it is taken out, and poured into a mould; first of all 3 parts of the slag is allowed to run out. The pot is then given a twist, to collect any metal that might be hanging to the sides of it; then poured *en masse* into the first. This should be only the work of a few seconds, or else it will all become stiff and pasty, thus preventing it being clearly poured out. It is then turned out from the mould to an iron plate, and allowed to cool, when it is broken. In the centre of the slag should now be found a well-defined button of lead, which should contain all the gold. It is then beaten into a cube, cupelled in the muffle-furnace, which in about half an hour should give a pure piece of gold.

I think this process saves the trouble of roasting, and also of not having to contend with the ferruginous scoriæ, as it may possibly contain small shots of lead, which decidedly would at once lessen the final result.—I am, &c.,

LATINI.

TRIPOLITE.

To the Editor of the Chemical News.

SIR,—The note by Dr. T. L. Phipson, on the "Tripolite of Barbadoes" reminds me of a deposit of a similar kind which I examined some time ago. It occurs in Lock Oich, one of the chain of lakes forming the Caledonian Canal, and was at one time dredged up in such quantity that it was proposed to be used for improving the land in the neighbourhood. My analysis showed it to be worthless for this purpose, as it consisted almost entirely of siliceous matter, partly fine particles of decomposed rock, and partly the remains of diatoms, most of which I found to belong to well species. Portions of the deposit were perfectly white, and, when dried, extremely light, and constituted a diatomaceous deposit of remarkable purity.—I am, &c.,

W. WALLACE.

Glasgow, September 18, 1876.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances, de l'Academie des Sciences. No. 7, August 14, 1876.

Thermic Formation of the Two Isomeric Propylic Aldehyds.—M. Berthelot.—The author concludes that the transformation of a normal and primary aldehyd into an isomeric secondary aldehyd liberates either a very small quantity of heat or none at all. He also proposes the following law:—Isomeric bodies, of the same chemical function, are formed from their elements with almost identical disengagements of heat, and the agreement exists also in the formation of their isomeric derivatives.

Thermic Researches on Hydro-sulphurous Acid.—M. Berthelot.—The author explains the greater stability of the ordinary hyposulphites in comparison with this new compound on the principle that, other things being equal, systems are the more stable as they have lost a more considerable portion of their energy.

Hydrated Aluminous Silicate deposited by the Hot Springs of St. Honore (Nievre).—M. Daubrée.—The composition of this mineral is represented as—

Silica	76·60
Alumina	12·60
Peroxide of iron	2·30
Lime	1·80
Magnesia	traces
Water	6·30
	99·60

Influence of Sonorous Vibrations on the Radiometer.—M. J. Jeannel.—I have observed that certain sonorous vibrations determine rotatory movements in the radiometer. With the assistance of MM. Coulier and Alvergniat I have made various experiments on this subject, which I wish to lay before the Academy:—In a half-dark place three radiometers, A, B, and C, of unequal sensitiveness and perfectly at rest, were placed on the inner surface of a saloon-organ. The low notes, those of the three first octaves, determine movements of rotation. The lowest notes have the greatest action, nevertheless the *fa* and *fa* sharp of the lower octave, especially with the sound of the drone, occasion the most rapid rotation. The *ut*, *ré*, and *mi*, although lower, act much less. All the radiometers do not behave in the same manner, either as to the rapidity or the direction of their movements. Thus, under the influence of *fa* or *fa* sharp of the lower octave the radiometer A (the least sensitive to light) revolves at the rate of about one turn per second, with the blackened surface of the discs foremost, that is to say, in the direction opposite to the motion produced by light. The radiometers B and C (more sensitive to light) turned more slowly, and in the direction of the revolution produced by light, that is to say, with the bright side of the discs forwards. I propose to explain these facts as follows:—As certain notes produce no effect, it is evident that the needle, the internal support of the "mill," must be able to vibrate in unison with the notes of the organ if a rotatory motion is to be produced. Certain vibrations of the sounding-board of the organ transmitted to the needle, impart to it circular or angular vibrations, whence results the rotation of the mill which it supports. What appears to demonstrate the soundness of this explanation is that on pressing the end of the finger on the top of the radiometer it is prevented from vibrating, and, at the same time, from revolving. The sounding-board of a piano produces analogous effects, but in a less degree. If we repeat the above experiments in a situation where the diffused light is almost sufficient to set the radiometer in motion, the low notes, even the faintest, occasion rotation in the ordinary direction with the bright surface of the discs forwards. The oscillation produced by passing vehicles suffices. This last result the author explains by the consideration that friction is momentarily overcome by vibration.

Action of Hydracids upon Tellurous Acid.—M. A. Ditte.—The author examines the behaviour of tellurous acid with the hydrobromic, hydrofluoric, and hydriodic acids.

Rhodein from an Analytical Point of View.—M. E. Jacquemin.—In a paper on erythrophenic acid (June 30, 1873), and in a memoir on "Phenol from an Analytical and Toxicological Point of View" (Scientific Congress at Lyons, 1873), it was laid down that if on adding traces of aniline to a liquid a blue colouration was obtained by means of the hypochlorite of soda, the presence of phenol might be inferred in the liquid in question. The author now considers this conclusion as too absolute, but holds that the production of rhodein cannot leave chemists in doubt. If to a certain volume of alcohol diluted with water, to 40° for instance, we add a drop of pure aniline, and then hypochlorite of soda, instead of obtaining the fugitive violet usual in aqueous solutions, we observe a yellowish colouration, passing sometimes into green, and sometimes into a permanent blue-green. If this reaction appears in a liquid which may possibly contain phenol, the presence of that body might be suspected. But to re-

move all doubt, the blue-green liquid, after some time, is diluted with an equal volume of water and a little of a dilute solution of the sulphide of ammonium. If aniline alone has produced the colour there appears the rosy-purple of rhodein, which finally fades into a yellow. If aniline and phenol are both present, the blue reappears in all its purity, and then also passes into yellow. To distinguish these two yellows, hypochlorite of soda may be added, which in the one case restores the fugitive violet of aniline, and in the other forms the blue erythrophenate, which the next day will be found to have retained its colour.

Researches on the Derivatives of Aceto-valerianic Ether.—M. E. Demarcay.—Not adapted for abstraction.

Examination of Chilian Minerals.—M. Domeyko.—The minerals described are the chloro-iodide of mercury and silver from Caracoles, and polybasic sulphates of copper, often forming a cupro-ferric alum.

No. 8, August 21, 1876.

Thermic Formation of Hydroxylamin or Oxy-ammonia.—M. Berthelot.—Not suitable for abstraction.

An Effect of Lightning during the Storm of August 18th.—M. A. Tréoul.—During the storm which came on in the morning of Friday last, I was occupied between 7 and 8 a.m. in writing at an open window. Heavy peals of thunder, which seemed to fall in the neighbourhood, took place at intervals. During the nearest, and almost simultaneously with them, small luminous columns descended obliquely upon my paper. The length of one of them was about 2 metres, and its greatest breadth 1½ decimetre. It was obtuse at its more remote extremity, it became gradually narrower, and was not more than 3 or 4 centimetres in breadth at the surface of my table. Their appearance was that of ignited gas with imperfectly defined outlines; their colour, not very intense, was yellow, slightly reddish, like that of many flames; but at the surface of the paper, where they hovered for some seconds, they had brighter shades. I did not remark the colour of the lower part of the first colour, but the second presented the bright colours (yellow, green, and blue) of the rainbow; the third was of a very bright blue, fading away almost to whiteness in contact with the paper. There occurred no detonation, only when about to become extinguished they quitted the paper with a slight rustling or hissing comparable to that made by a drop of water thrown upon a hot plate of metal. No odour was perceptible, and the paper was neither stained nor affected. My steel pen was not acted on and I myself felt nothing.

Electric Regulator to Maintain the Movement of the Pendulum.—M. Bourbouze.—This paper requires the accompanying illustration.

Bead Lightning.—M. G. Planté.—The storm which burst over Paris on the morning of August 18 offered an instance of a kind of lightning very rare, not rightly classified by meteorologists, and calculated to throw a new light on the formation of globe lightning. Some flashes were distinctly bifurcated, but one formed as it were a chaplet of brilliant granules, diffused along a narrow luminous band. This flash, which we observed from the heights of Meudon, appeared to strike Paris in the direction of Vaugirard. Similar flashes are described by M. Th. du Moncel as having been observed during a storm at London in the night between the 19th and 20th of June, 1857. They seemed to remain for a few moments, and then seemed as if melted up into granulated light.

Equivalent Substitution of Mineral Matters which enter into the Composition of Animals and Plants.—MM. P. Champion and H. Pellet.—In the ash of the flesh of different animals and of hens' eggs the phosphoric acid is almost constant, as well as the total amount of acid capable of saturating bases. For ashes of different compositions the weight of sulphuric acid saturating the bases is so much the higher as there are more bases of low equivalents. The ash of veal contains more soda than the ash of beef, and the ash of the eggs of pullets present the same feature if compared with the ash of the eggs of adult hens.

Fermentation of Urine.—M. Ch. Bastian.—A reply to M. Pasteur.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

Improvements in the manufacture of alkalies and hydrochloric acid. G. W. Hart, Grosvenor Road, South Norwood, Surrey. (Partly a communication from J. Bennet, Michigan, U.S.A.) May 29, 1875.—No. 1976. This Specification describes fusing silica with chloride or sodium on the hearth of a furnace in the presence of hydrogen of vapour of water.

An improved method of and apparatus for the manufacture of gaseous liquids. A. A. Mondollot, Boulevard de Strasbourg, Paris. June 1, 1875.—No. 2007. This consists in an apparatus for the production of carbonic acid gas, whereby lime and sulphuric acid are brought into contact and mechanically agitated, or hydrochloric acid and carbonate of lime or other materials, reacting upon one another without agitation, are mingled in a convenient way.

Improvements in the manufacture of chlorine. H. Deacon, Appleton House, Widnes, Lancaster. June 1, 1875.—No. 2003. The essential feature of this invention, which relates to improvements in the production of chlorine by what is known as Deacon's process, consists in the employment of purifying materials or agents for the purpose of removing sulphuric acid from the hydrochloric acid gas employed in conjunction with heated air, and brought in contact with porous or other substances impregnated with or containing sulphate of copper, or with those in my former Specifications termed active substances.

Improvements in and in apparatus for the separation of the oily and farinaceous constituents of maize, and in the application of the same for the manufacture of various useful products. A. M. Clark, Chancery Lane, Middlesex. (A communication from L. Chiozza, Paris.) June 1, 1875.—No. 2007. The essential feature of the process consists in operating by means of rolls or screens on the grain, previously treated with a solution of sulphurous acid, and whilst it is undergoing a gradual drying; the process being applicable, with slight variation, to the manufacture of oil, of a white and sweet flour, of dextrin, beer, fermented liquors, vinegar, alcohol, starch, glucose syrup, and glucose.

Improvements in the production of protosulphuret of iron and sulphuretted hydrogen gas for the extraction of copper from mother-liquors, and for other purposes. G. T. Bousfield, Sutton, Surrey. (A communication from the Société Anonyme de Cuivre Franais, Paris.) June 3, 1875.—No. 2042. The claims to this complete Specification are the new combination of apparatus and means resulting in a production of sulphuretted hydrogen gas on a large scale, and in a new manufacture which has not hitherto been practically realised, and which is attained by the construction, disposition, and grouping of the apparatus, by heating the acid for the attack before its introduction into the vessels, which hastens the reaction on the protosulphuret, and, in consequence, increases the quantity of gas, which can be disengaged in a given time by the withdrawal of the sulphate of iron at the lower part of the vessel, which permits its extraction even during the production of the gas, and gives the means of drawing off the acid to stop the disengagement of the sulphuretted hydrogen, when desired by employing a helix as a means of stirring. Also the method described for the manufacture of protosulphuret of iron.

NOTES AND QUERIES.

*** Our Notes and Queries column was opened for the purpose of giving and obtaining information likely to be of use to our readers generally. We cannot undertake to let this column be the means of transmitting merely private information, or such trade notices as should legitimately come in the advertising columns.

Adulteration of Red Wines.—As the adulteration of red wines with aniline has been brought under our notice by the press, your readers might like to know of some ready means to detect the adulteration; and as I have not seen any very ready means published in your journal, I have taken the liberty of sending you one which I have tried with success. I first take a small quantity of port and precipitate with diacetate of lead and filter, and if the wine be pure it will be quite clear; but if it contains the least trace of aniline the precipitate will be coloured red, according to the amount present. I have tested it myself. Even ¼ of a grain to the litre can be seen, because with pure wine it is left quite clear like water if properly done.—A. Smith.

Will shortly appear, a Second Revised and Augmented Edition of

BUTTER: its ANALYSIS and ADULTERATIONS. By Otto Hehner and Arthur Angell, Public Analysts.

F. W. HART, Manufacturer and Dealer in Apparatus and Chemicals for Scientific Pursuits. Laboratory Fitter and Furnisher. Photographic Apparatus and Materials. 8, Kingsland Green (West Side), London.

THE CHEMICAL NEWS.

VOL. XXXIV. No. 879.

REPORT ON THE LIMITED OXIDATION OF ESSENTIAL OILS, PART IV.; CONTAINING A PRELIMINARY REPORT ON THE ETHERS.*

(Concluded from p. 128.)

By CHARLES T. KINGZETT, F.C.S., London and Berlin, &c.

THE following experiments were conducted in order to ascertain to which constituents of my solution the antiseptic and disinfecting character is to be ascribed:—

Camphoric Acid Experiments.

0·3 grm. of the acid in water was sufficient to preserve 400 c.c. milk unaltered for 7 days. After that a scum appeared and a cheesy taste. But it did not go solid and sour till the 11th day.

0·1 grm. camphoric acid kept 50 c.c. of flour paste fresh for 11 days. On the 12th day it became sour.

0·1 grm. camphoric acid preserved 50 c.c. grape juice in a warm oven from fermentation permanently so far as could be observed.

0·1 grm. camphoric acid kept 15 c.c. egg albumen and 10 c.c. water fresh for 21 days. Became mouldy afterwards.

0·1 grm. camphoric acid preserved 200 c.c. bitter beer unaltered for 11 days in an open vessel. It afterwards became covered with fungus.

Peroxide of Hydrogen Experiments.

The strength of the solution used was that of Robbin's 10 volume solution.

10 c.c. preserved 400 c.c. milk for 6 days, meanwhile oxygen was slowly evolved; thick and sour on the 11th day.

5 c.c. preserved 47 c.c. grape must from fermentation for some 24 hours, then bubbles of oxygen were liberated; finally it had an odour like apples.

5 c.c. preserved 15 c.c. albumen (egg)+10 c.c. water fresh for very many days.

5 c.c. preserved 400 c.c. bitter beer unaltered for 26 days; then sour; fungus did not appear.

5 c.c. preserved 30 c.c. flour paste for 6 days; afterwards went bad.

Experiments with Salicylic Acid.

0·1 grm. preserved 100 c.c. bitter beer for 25 days, but gave to it a most peculiar taste—spirituous, bitter sweet. No longer observed.

0·1 grm. preserved 100 c.c. milk for four days. On the 5th it was sour and cheesy, and on the 7th it stunk.

0·1 grm. preserved 50 c.c. flour paste for a number of days, but acquired even on the 4th day a very stale odour.

0·1 grm. preserved 23 c.c. egg albumen, and 12 c.c. water fresh for 4 days. On the 5th it stunk.

These experiments, as also those with camphoric acid and peroxide of hydrogen, were all conducted during October, November, December, 1875.

I will conclude these remarks by pointing out that the solution whose properties have been described has a somewhat bitter but not unpleasant taste; it is non-poisonous, and harmless to clothing and furniture. While its antiseptic power is distributed between the peroxide of hydrogen and camphoric acid, the former of these is able to evolve large quantities of oxygen, which in this state is nascent and of a powerful oxidising character. Finally, I desire to express my thanks to my friend Dr. H. W. Hake for having rendered me much help during the prosecution of this part of my investigation.

C. I now propose to treat of the more strictly scientific part of my report, and by way of introduction, I may be allowed to state that it has been established by my former researches, that all the members of the terpene family represented by the formula $C_{10}H_{16}$ give peroxide of hydrogen by atmospheric oxidation, and I have further pointed out that this property is undoubtedly related to cymene ($C_{10}H_{14}$) which, as obtained from various sources, also yields peroxide of hydrogen, so that any hydrocarbon containing cymen as a proximate nucleus would presumably give peroxide of hydrogen under suitable treatment. Since my last publication, I have been able through the kindness of Dr. Wright, who placed a small quantity of menthene, $C_{10}H_{18}$, at my disposal, to investigate that body according to the method instituted by me. 18·5 grms. menthene, from solid Japanese camphor, on oxidation in a current of air at a temperature of 60° C., in the presence of 100 c.c. water, gave a solution in which the amount of peroxide of hydrogen was estimated by the iodide of potassium method after forty-four hours, and found to = 0·09114 grm. H_2O_2. A further amount was produced on continuing the oxidation. Meanwhile the oil grew yellow and thick, but was not further examined on account of the small quantity. The aqueous solution contained also acetic and formic acid, which where identified by the usual tests, and further an oily body which was deposited on concentration. This last body on oxidation with strong nitric acid (1 : 1) gave a yellow solution which was neutralised by soda, and this solution was found to give a barium salt insoluble in water, and also a precipitate with nitrate of silver. This silver salt on heating deflagrated, was found to contain more than 64·45 per cent silver (a little was perhaps lost). A small quantity of menthene derived from *liquid* Japan camphor by the action of zinc chloride gave similar results to those above ascribed to menthene from *solid* Japan camphor.

This limited inquiry exhausted my supply of menthene, nevertheless it supports the conclusion I stated in the third part of these researches (CHEMICAL NEWS, vol. xxxii., p. 138) to the effect that all bodies having cymene as a proximate nucleus give peroxide of hydrogen on oxidation by air. For Dr. C. R. A. Wright has (*Journ. Chem. Soc.*, series 2, vol. xiv., p. 2), by the action of bromine upon menthene succeeded in obtaining a terpene from it in the first place, and on further bromination, cymene. I have also demonstrated that clove terpene, $C_{15}H_{24}$, by the fact that it fails to give peroxide of hydrogen in oxidation, does not contain cymen as a proximate nucleus. And more recently Dr. Wright has supported this statement by showing that clove terpene gives no cymene by the action of bromine. Regarding cymene (paramethylpropyl benzene $C_6H_4(CH_3)(C_3H_7)$ as a hydrocarbon constituted of proximate nuclei, I was led by a study of the subject to consider the possibility of obtaining peroxide of hydrogen by the atmospheric oxidation of suitable compounds containing methyl, propyl, &c. And for the obvious reason that the ethers may in a sense be considered as oxides of the hydrocarbon radicles of the marsh-gas series, I fixed upon them for my first experiments.

Ordinary ethylic ether has for long been credited with the power of producing ozone, but beyond this, the subject was at the time I commenced my investigation in a similar state of mystery to that which surrounded the so-called formation of ozone by the oxidation of essential oils. That is to say nothing was known about it, beyond that there had been recognised under these conditions a principle which was mistaken for ozone, and of whose production there was no reasonable theory.

I do not propose to relate in detail my experiments, which are necessarily incomplete, but shall only state that ethylic ether gives apparently, by atmospheric oxidation,

* Read before the British Association (Section B.), Glasgow Meeting.

acetic ether and certainly peroxide of hydrogen. This latter I have obtained in estimable amount, but this subject presents great difficulty in working, on account of the volatile nature of the ether chiefly, and most of its compounds and derivatives.

The following equations may possibly represent what occurs when ethylic ether is oxidised in the presence of water in the way I have described.

$$(1.)\ \left.\begin{matrix}C_2H_5\\C_2H_5\end{matrix}\right\}O+O_2=\left.\begin{matrix}C_2H_3O\\C_2H_5\end{matrix}\right\}O+H_2O.$$

$$(2.)\ \left.\begin{matrix}C_2H_3O\\C_2H_5\end{matrix}\right\}O+O_3=\left.\begin{matrix}C_2H_3O\\C_2H_3O\end{matrix}\right\}O_2+H_2O.$$

$$(3.)\ C_2H_3O\}O_2+2H_2O=\left.\begin{matrix}C_2H_3O\\H\end{matrix}\right\}O+\left.\begin{matrix}C_2H_3O\\H\end{matrix}\right\}O+H_2O_2.$$

$$\left.\begin{matrix}CH_3CO\,O\\CH_3CO\,O\end{matrix}\right\}+\left.\begin{matrix}H\,HO\\H\,HO\end{matrix}\right\}=\left.\begin{matrix}CH_3CO\,OH\\CH_3CO\,OH\end{matrix}\right\}+\left.\begin{matrix}HO\\HO\end{matrix}\right\}$$

These equations may be explained as representing—

(1.) The oxidation of ether into acetic ether and water.

(2.) The oxidation of acetic ether into the anhydride, and that into the peroxide.

(3.) The decomposition of the latter with water, simultaneously with its formation.

I believe that we must assume the formation of acetic peroxide, a body which as yet has only been prepared by Brodie by acting on acetic anhydride with barium peroxide.

In my experiments it would appear that ordinary atmospheric oxygen plays the same part as the oxygen of the barium peroxide in Brodie's method.

If this be so, the mode by which the peroxide of hydrogen is assumed to be formed, would give strength to my theory regarding its production from turpentine which may be represented, first as its oxidation into camphor (corresponding to ether); secondly, the oxidation of this body into camphoric anhydride, and the anhydride finally into the peroxide, which is slowly decomposed by water.

I have observed these properties and isolated the products of its change by water, but have not succeeded further.

My method of experiment I hope, at no distant period, to apply to all the ethers available. Meanwhile the preliminary results I have obtained in this new direction already foreshadow a system of classification of the terpene derivatives.

Finally, I submit that the production of peroxide of hydrogen from camphoric peroxide (in the case of turpentine), and acetic peroxide (in the case of ether), amounts to a demonstration of the existence of the radical hydroxyl in compounds, and in a sense may be considered as the isolation of hydroxyl itself.

NOTE ON ANTHRACEN TESTING.*

By J. T. BROWN.

In the earlier days of anthracen manufacture, when it was obtained solely from the last runnings of oil, and when the distillation was stopped comparatively early, for the double reason of saving the bottoms of the stills and producing a good marketable pitch, the principal solid impurities were naphthalen, phenanthren, and paraffin. With samples of this description the method of testing by agitation (after washing with petroleum spirit) with a limited quantity of bisulphide of carbon gives approximate and practically useful results. When, however, the demand for anthracen increased, the tar distillers commenced to continue the distillation as far as possible, and only to stop the operation just before the point at which coking begins. This method of working gives some entirely different samples of crude anthracen, viz., those in which the principal solid impurities have higher boiling-points than anthracen. Then bisulphide of carbon fails to remove; that test, therefore, with these samples ceases to give correct indications of their commercial value. To correct this the anthrachinon test was introduced, and was, judging from the terms in which it was proposed, looked upon as applicable to *all* commercial anthracens. The appendix which soon followed showed that experience had not confirmed those anticipations, and now the kinone produced requires to be tested as to its purity, seeing that the resulting product is by no means definite. In applying the kinone test to commercial samples various minor difficulties occur, one of which is that damp samples of anthracen are apt to lose moisture during the time that is occupied in reducing them to a sufficient degree of fineness to allow the small quantity of 1 grm. to be a correct sample of the bulk, and another and more serious one is the uncertainty caused by the occasional occurrence of accidental impurities in the quantity weighed out. To remedy these defects, and facilitate the testing, I should propose the following modification:—

Weigh out 50 grms. of the crude anthracen, and measure out 250 c.c. of petroleum spirit; triturate the anthracen in a mortar with a sufficient quantity of the spirit to form a thin cream, and pour it into a weighed filter (taking care at the same time to leave in the mortar any grit or sand which may be present; rinse on to the filter any anthracen which may be round the sides of the mortar, and employ the remainder of the spirit in washing the filter and its contents. Allow them to drain, then fold carefully, press between bibulous paper, dry at about 60° to 80° C., and weigh. Crush to fine powder the contents of the filter, and from that quantity weigh out the gramme required, then proceed in the usual manner with the kinone test and appendix. In calculating the result, allowance must of course be made for the diminution in weight caused by washing the crude sample with petroleum spirit.

I would recommend the preliminary washing because it has the following advantages in addition to those already mentioned:—It yields a dry powder of perfect uniformity, from which it is easy to weigh out a small quantity.

It removes, besides others, the greater part of two important impurities, one of which, paraffin, defies the kinone test, and the other, phenanthren, if present in large quantities, is not completely oxidised under a considerable time. And as the result of the removal beforehand of a large quantity of the impurity the oxidation proceeds more quietly, and the kinone obtained is more crystalline, and freer from chromium compounds.

* Read before the British Association, Glasgow Meeting (Section B.)

REPORT OF THE SEWAGE COMMITTEE OF THE BRITISH ASSOCIATION.*

This Report was read by Dr. Corfield. It narrated the work of the committee during the past year at Breton's Farm, near Romford. During the months of June, July, August, and September little or no nitrogen, as nitrates or nitrites, was found in the effluent water, and from this it might hastily be concluded that for some reason or another the usual amount of oxidation had not gone on the soil; but the fact turns out to be that oxalic acid had been added to the samples (both sewage and effluent water) of these months with the view of preventing oxidation going on in them during and after collection. The true average amount of nitrogen in the sewage was 5·53 parts per 100,000, and the amount of nitrogen calculated to be applied to the farm in the sewage was 30·2525 tons. Of this quantity, 0·1406 ton was collected in the effluent water re-pumped over the farm. It was remarkable how little the true average composition of the sewage differed from the results obtained in previous years, and the committee considered that this circumstance afforded con-

* Read before the British Association, Glasgow Meeting, (Section B.)

siderable proof of the accuracy of their methods of sampling, the principle of which had always been that the samples should be taken in proportion to the amount of flow at the time. Thus the amount of nitrogen in parts per 100,000 in the sewage had been, according to the calculations from the results of the gauging and analyses, as follows :—

1871—72	5·529
1872—73	5·151
1873—74	not taken
1874—75	5·560
1875—76	5·530

The rainfall in 1872-3 was excessive, which accounted for the small proportion of nitrogen, and with regard to 1874-5 the number given was the result of a single analysis of all the monthly samples taken in quantities proportionate to the amounts of sewage distributed each month. Experiments made with bottled sewage and effluent water (kept for some time) showed that the total amount of nitrogen in the solid matter was not altered by keeping. The nitrogen in the effluent water was almost all converted into nitrates. This applied to filled bottles. In the case of unfilled bottles, a large quantity of the nitrogen in the sewage was lost, while in the effluent water it was only slightly diminished in amount, but was almost all oxidised to the condition of nitrates. Regarding the produce of the farm, the report stated that three plots of Italian rye-grass yielded respectively 58, 53, and 48 tons per acre. The highest average of mangold crops had been nearly 47 tons per acre. The nitrogen recovered in the crops was 20,558 lbs., equivalent to 30·34 per cent of that received in the sewage. Dr. Corfield concluded by stating that the lease of the farm being now up, and as another field of operations had not yet been obtained, the committee did not in the meantime ask to be re-appointed.

Mr. E. C. C. STANFORD said he was sorry that the report of the Sewage Committee had developed very much into a mere report on irrigation. The committee had done valuable work, no doubt, but they had not treated this subject of sewage in the broad way to which it was entitled, and the result was that no question had been thoroughly sifted, save that of Mr. Hope's farm. Even in connection with that the committee had left out what sewage reformers wanted most to know, namely, the balance-sheet.

Dr. GILBERT said he thought it would be found that, in the earlier years of the committee's work, they had investigated other processes besides that of irrigation, and had reported upon them, though, for substantial reasons, investigation was not followed up. Mr. Stanford had lamented the absence of a balance-sheet in connection with the report on Mr. Hope's farm. In reply to that he was quite free to admit that there had been a loss on the working, but his clear opinion was that, loss or not, the country ought to resort to irrigation.

Mr. SPENCE said it had come to be a question between precipitation and irrigation, and the latter was nearly impracticable in the case of very large towns. His conviction was that precipitation by sulphates was the only true solution.

Mr. W. R. W. SMITH had no doubt that for large towns irrigation was simply impossible. Five or six years ago, when the Rivers Pollution Commissioners said there was nothing for it but to irrigate, he told them he would make the prediction that no man then alive would ever see irrigation adopted in Glasgow. He took Dr. Chalmers Morton's figures, and calculated from these that it would require 20 square miles for the production of grass, and that it would take all the cattle in the three counties of Lanark, Renfrew, and Dumbarton to eat that grass; or, if they grew other crops, it would require 120 miles of land. Now, where were they to get such a space of ground for irrigation purposes? With regard to Mr. Coleman's paper (CHEMICAL NEWS, vol. xxxiv., p. 125), he had seen that gentleman's experiments and considered them very satisfactory. It was urged against it that the manurial produce was not worth much, but here in Glasgow they were able to sell the veriest rubbish of city manure at a good price, and surely there could be no difficulty in selling a better quality. From what he had seen of Mr. Coleman's process, and of the A B C process, he had come clearly to the conclusion that very much could be done by using the cheap charcoal which lay in such abundance at our doors. But we must get rid of adopting a general principle to every particular case, and rather consider all the individual circumstances which would make it easy or difficult to deal with the sewage of a town. Much might be done too by getting the large public works to adopt the most available methods.

Some further discussion followed, in the course of which the Lord Provost asked if the Sewage Committee would explain how irrigation could be adoped in the case of such a city as Glasgow, where there was a vast population, and where land in the neighbourhood was scarce and out of level with the town.

Dr. GILBERT replied that no doubt an enormous quantity of land would be required in the case of Glasgow, but a mixed system of irrigation and filtration through soil might be adopted.

ON A NEW CHEMICAL TEST FOR ALCOHOL.

By EDMUND W. DAVY, A.M., M.D., Professor of Forensic Medicine, Royal College of Surgeons, Ireland, &c.

WHILST making lately some experiments on molybdic acid, I observed that when a solution of that substance in strong sulphuric acid was brought in contact with alcohol, there is very quickly developed a deep azure blue colouration; and this fact, being (as far as I was able to ascertain) hitherto unrecorded, led me to investigate the reaction to determine the cause of this production of colour.

As I found that the protosulphate of iron, and the protochloride of tin, two powerful deoxidising salts, produced a similar effect on this solution, there was but little doubt that it was due to the deoxidising action of alcohol on the molybdic acid. And I afterwards found that the blue substance which was formed in the case of alcohol possessed all the characters of the blue compound which is produced when molybdic acid or its salts are acted on by different reducing agents, whereby a substance consisting of five atoms of the metal molybdenum with fourteen of oxygen is obtained, which is usually regarded as a combination of the binoxide of molybdenum with molybdic acid, the following formula (MoO_2,4MoO_3) representing its composition.

With certain precautions, which I shall presently point out, I have found that this reaction of alcohol on the molybdic solution stated is extremely sensitive, so that by its indications very minute quantities of alcohol, even when diluted with large proportions of water, may be readily detected. Thus, for example, if one part by volume of commercial rectified spirits be mixed with 100 parts of distilled water, and one small drop of this mixture be taken, the minute quantity of spirit contained in it can be easily detected by the deep blue colouration which will be immediately developed on bringing it into contact with the molybdic solution, employed in the manner about to be described. But this is not the limit of the delicacy of this test, for I have been able by means of it to detect the spirit in one drop of a mixture of distilled water and anhydrous spirit, in which the latter substance constituted only the one-thousandth part of its volume; and as the drop was found to weigh 6-10ths of a grain, the quantity of real or anhydrous alcohol contained in it would be less than the 1-1666th part of a grain of that substance.

* A paper read before the Royal Irish Academy.

Though small quantities of spirit, even when considerably diluted with water, will produce with the molybdic solution the blue reaction without the assistance of any external heat, still, where very minute quantities, diluted with such large proportions of water as those just stated, are to be detected, it is necessary, for the success of the experiment, that the reaction should be assisted by a gentle heat, and also that too great a dilution of the test solution with the liquid under examination should be avoided, as the blue colouration will not be developed if water be in excess; and even after it has been produced, the addition of a certain proportion of that substance quickly causes its disappearance. Such being the case, the best way of employing the test, according to my experience, is to place three or four drops of the molybdic solution in a small white porcelain capsule, and having heated them slightly, allow one or two drops of the liquid to be examined to glide or fall gently on the acid solution, when there will be developed, either immediately or after a few moments, the blue colouration. And where the alcohol is very largely diluted with water, it is better to continue the gentle heating of the test solution for some time, to concentrate it or expel as much water from it as possible, before adding the liquid to be tested, for, in this way, I have succeeded in detecting the spirit in mixtures so dilute as to give no blue reaction when added immediately to the test solution on its being simply warmed. As regards the application of heat, I must observe that the temperature of the acid solution must not be raised too high, for if it be heated till the acid evolves its dense vapours, or begins to boil, the solution will of itself alone, from its partial decomposition, develop a more or less blue colouration, which will become more perceptible on its cooling. But such an occurrence can be easily avoided by employing a water-bath as the heating agent; for I have found that a temperature of 212° F. is incapable of so acting on the test solution—at least an exposure of several hours' duration to that heat failed to produce the slightest blue colouration, and a much lower temperature than that suffices for the application of the test.

I should here state that the molybdic or test solution which I have generally employed was made by dissolving at a gentle heat 1 part by weight of molybdic acid in 10 parts of strong and pure sulphuric acid, but the exact strength of this solution as regards the amount of molybdic acid it contains seems to be immaterial.

I may observe that the colouration produced in the reaction stated disappears after a variable interval of exposure to the air—a circumstance which is due, as I have ascertained, to the absorption of moisture from the atmosphere, and not to the re-oxidation of the molybdenum compound, as might have been supposed; for amongst other facts in proof of this, I may state that after it has thus disappeared, it may be readily restored either by expelling the water so absorbed by a gentle heat, or, more slowly, by placing the mixture under a desiccator, and thus removing it by spontaneous evaporation at the ordinary temperature. Such being the case, it is evident that, where the test solution has been too much diluted for the immediate development of the colouration described, expelling the excess of water by heating the mixture on a water-bath, it may be made to exhibit itself.

But the necessity for such evaporation should, if possible, be avoided, which, in most cases, will be so by using only a drop or two of the liquid under examination, and by employing the strongest sulphuric acid in making the test solution; for it is very probable that much of the spirit contained in the liquid would be lost during its evaporation in the water-bath; besides, there would be some risk that the indications of the test might be more or less interfered with from particles of dust or organic matter getting into the mixture during that process.

The reaction which has been described, I should state, is not peculiar to ordinary or ethylic alcohol, but is more or less readily developed by others—at least I found it to be so in the case of methylic, propylic, butylic, and amylic alcohols, those being the only ones I had for my experiments. But it is more than probable that some at least of the other alcohols may act in a similar manner; however, the reaction is much more rapid and striking in the case of ethylic than in that of any of the other alcohols mentioned. I found also that certain salts of the radicles of those alcohols produced a somewhat similar reaction, as well as ethylic ether and aldehyd, and also several organic matters which are readily susceptible of oxidation.

The circumstance that the reaction described is not peculiar to ethylic alcohol will, no doubt, lessen its value as a positive test for that substance; but a similar objection appertains to all the other known tests for that compound, as their indications are not peculiar to that alcohol alone, if we except, perhaps, Berthelot's test, which is founded on the development of benzoic ether by the action of benzoic chloride, along with caustic potash on ethylic alcohol. But, owing to the trouble attendant on the preparation of benzoic chloride, and some other practical inconveniences connected with the application of that test, it is not likely that it will ever come to be one of very general employment.

The test, however, which I have brought before the Academy has this advantage over those already known, that it far exceeds (according to my experiments) any one of them in point of delicacy. And though the circumstance that the blue reaction produced in the case of this test is not peculiar to ethylic spirit lessens, as before observed, its value for the detection of that substance, this is just what renders the test of more general applicability; for by its aid certain impurities or adulterations may be at once detected in different substances or compounds, which in a state of purity should not contain any matter capable of acting on the molybdic solution employed in this test. I may refer to two important substances as examples, viz., chloroform and chloral hydrate, which are now so extensively employed in medicine and surgery for a number of useful purposes; and being agents of great power, it is of much importance that they should be free from the accidental impurities of imperfect preparation, as well as from the frauds of intentional adulteration, which may either impair their therapeutic value, or even increase the danger of their administration. For there can be but little doubt that in some instances the serious and even fatal effects resulting from their use may, in part at least, have been attributable to the impurities or adulterations of the chloroform, or of the chloral hydrate employed. Now, as I find that neither chloroform nor chloral hydrate, in their pure condition, have any apparent action on the molybdic test, but that many of their usual impurities develop the blue reaction, it affords us a ready means of testing their purity. Thus, as regards chloroform, one of its common impurities is ethylic alcohol, which it may contain either from imperfect preparation, or from fraudulent addition, the very high price of chloroform offering a great temptation to the unscrupulous vendor to increase its bulk or weight by the addition of alcohol, which so readily mixes with it. I have found that the molybdic test at once enables us to detect such an adulteration, even where it occurs in very small proportions in chloroform. Thus, in one experiment, I mixed 1 part of rectified spirit with 100 parts by volume of pure chloroform, and one drop of this mixture being brought in contact with three or four drops of the molybdic solution, previously warmed in a water-bath, gave an immediate deep blue colouration from the spirit contained in it; and, in a second experiment, with a mixture of 1 part of spirit to 1000 parts of chloroform, a single drop of the mixture, being similarly treated, developed a faint blue reaction. Indeed, so searching is this test as regards the purity of chloroform, that I was unable to obtain any sample of that substance in commerce sufficiently pure not to give a blue reaction with the molybdic test, owing to the minute quantities of volatile oils, and other impurities, they contain; and for

my experiments I was obliged to re-purify the commercially pure chloroform to obtain a sample which would give no coloured reaction with my test.

In the case of chloral hydrate, it is stated that one of its usual impurities is the chloral alcoholate (a compound in which alcohol, instead of water, is combined with anhydrous chloral), and that this substance has somewhat different effects on the system from those produced by the hydrate. This compound, owing to the alcohol it contains, gives the blue reaction with the molybdic test, and I have found that where the chloral hydrate contained even so small a proportion of the alcoholate as 1 part in 1000 parts, a little of such a sample being taken indicated its presence when examined by the molybdic test; and it is probable that some of the other impurities which are met with in this important substance may be similarly detected.

Those two examples are sufficient to indicate the use to which this test may be applied in the determination of the purity of different substances used in medicine, as well as in scientific research.

Finally, I would remark that, as the reaction of molybdic acid on ethylic alcohol is so sensitive and prompt in its action, I entertain the hope that there may yet be founded on it, not merely this qualitative test, but likewise a means for the quantitative determination of that important alcohol.

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 118.)

Chlorine, Bromine, Iodine, and Fluorine.
By Dr. E. Mylius, of Ludwigshafen.

Potassium Chlorate.—No important change in the manufacture of the chlorate of potash has been introduced in the last few years. Now, as well as formerly, it is everywhere made according to Liebig's original process, hot milk of lime being saturated with chlorine, and the calcium chlorate, formed simultaneously with calcium chloride, being decomposed by potassium chloride.

In England, which produces the bulk of the chlorate of potash of commerce, it is at present, according to Lunge, obtained in the following manner.†

For saturating the milk of lime are employed two iron cylinders, lined with lead, connected with each other, and fitted with agitators. These cylinders communicate with each other, and with the chlorine still by means of tubes, and in such a manner that the contents of the one approach the state of complete saturation, whilst in the other any chlorine which may have escaped absorption is taken up by fresh milk of lime. As soon as perfect saturation has been attained in the first receiver, its contents are replaced by fresh milk of lime, and the current of chlorine is turned so that it may first enter the second apparatus. The solution of chloride and chlorate of calcium thus obtained has a rose-red colour, due, according to some authorities, to permanganic acid; but which, according to others (Crace-Calvert), appears also in the absence of manganese. In fact, this rose colour of the liquid is observed also as a sign of the complete saturation of the liquid where the chlorine employed is obtained without the use of manganese as at Kunheim's works at Berlin, where chlorine obtained by Deacon's process is used in the preparation of chlorate. The red liquid after clearing with chloride of potassium is evaporated down to the sp. gr. 1·28 and allowed to crystallise. The liquid drawn off from the first crop of crystals is further evaporated down to 1·35, when a second smaller quantity of chlorate of potash is obtained. A portion, about 12 per cent, of the chlorate of potash remains in the mother-liquor, which can therefore be treated as a source of chlorine. The crystals obtained are still contaminated with chloride of potassium and iron. To remove these impurities the crude salt is dissolved in the smallest possible quantity of hot water, 2·5 kilos. of soda are added to 10 hectolitres of the solution, and after the carbonate of lime and oxide of iron have been deposited it is allowed to crystallise. The crystals are dried in drying-rooms; the larger ones are sold without further treatment, and the smaller ones are ground between rollers. This process, in spite of every care, is sometimes attended with explosions. Lunge therefore recommends to crystallise the salt with constant agitation, and thus obtain it as a crystalline powder. In this manner the purification might also be more readily effected, as easily-soluble salts could be removed from the crystalline powder by merely washing with water.

Whilst considerable quantities of chlorate of potash are manufactured in England this branch seems to be scarcely remunerative in Germany, where the same method of preparation is adopted. Several establishments have recently abandoned the manufacture. According to the experiments of F. Hobrecker, 100 parts of chlorate of potash require — 4431·0 hydrochloric acid (20° B.); 772·0 manganese (65 per cent); 418·0 lime; 72·7 chloride of potassium (92 per cent; 2262·0 lignite.

Bromine.—However considerably the production of bromine had increased in the earlier decennial periods of its manufacture on the large scale, and however easily vast quantities of this body could be made available for the arts, its industrial applications, and consequently its production, have increased very little in the last few years. Whilst formerly the raw material for its preparation was derived from the mother-liquors of salt springs and from sea-water, especially that of the Dead Sea, which though richly bromiferous is too remote from the centres of consumption for chemical products, a new source has been discovered in the mother-liquors of the clearing salts (Abraum salz) of Stassfurt, which can be easily adapted to the demand. In spite of the quantity of bromine which can be obtained at Stassfurt it is merely a by-product of the potash trade, as, in consequence of the small demand and low commercial value, the cost of production falls little short of the market price. The utilisation of the Stassfurt "abraum" salts as a source of bromine dates from the year 1865, when A. Frank introduced this branch of industry in order the better to compete with the potash from kelp and from salt-springs, and also in the hope of superseding the use of iodine in the manufacture of colours.

(To be continued).

* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzehends."
† Lunge, *Dingl. Pol. Journ.*, cxxcix., 489.

ON THE
PREPARATION OF SOME COLOURED FIRES (BENGAL LIGHTS) USED IN PYROTECHNY.

By SERGIUS KERN, St. Petersburg.

In preparing coloured fires for fireworks by means of the usual formulæ given in many manuals of pyrotechny it is often very necessary to know the quickness of burning of coloured fires, so as in some cases, as decorations and lances, they must burn slowly, in other cases, as wheels, stars for rockets, and Roman candles, they must burn quicker. Working for some months with many compositions of such kind, I prepared three tables of coloured fires (red, green, and violet), where every formula with a higher number burns quicker than a fire with a lower number. For instance, No. 5 burns quicker than No. 6

and slower than No. 4. These tables will, I think, be of much assistance in the preparation of fireworks.

Green-coloured Fires.

No.	Potassium Chlorate. Per cent.	Barium Nitrate. Per cent.	Sulphur. Per cent.
1.	36	40	24
2.	29	48	23
3.	24	53	23
4.	21	57	22
5.	18	60	22
6.	16	62	22
7.	14	64	22
8.	13	66	21
9.	12	67	21
10.	11	68	21
11.	10	69	21
12.	9·5	69·5	21
13.	9	70	21
14.	8·5	70·5	21
15.	8	71	21

Red-coloured Fires.

No.	Potassium Chlorate. Per cent.	Strontium Nitrate. Per cent.	Sulphur. Per cent.	Carbon Powder. Per cent.
1.	40	39	18	3
2.	32	46	19	2
3.	27	51	20	2
4.	23	55	20	2
5.	20	58	20·5	1·5
6.	18	60	21	1
7.	16	61·6	21·2	1·2
8.	15	63	21	1
9.	13	64	22	1
10.	12	65	22	1
11.	11	66	22	1
12.	10	67	22	1
13.	10	67·25	22	0·75
14.	9·25	68	22	0·75
15.	9	68·35	22	0·65

Violet coloured Fires.

No.	Potassium Chlorate. Per cent.	Calcium Carbonate. Per cent.	Malachite, powdered. Per cent.	Sulphur. Per cent.
1.	52	29	4	15
2.	52	28	5	15
3.	52	26	7	15
4.	52	24	9	15
5.	52	23	10	15
6.	52	21	13	15
7.	51	20	14	15
8.	51	18	16	15
9.	51	16	18	15
10.	51	15	19	15
11.	51	13	21	15
12.	51	11	23	15
13.	51	10	24	15
14.	51	8	26	15
15.	51	6	28	15

PRELIMINARY NOTE ON LITMUS.*

By HOWARD W. MITCHELL.

WARTHA† has separated four organic bodies from litmus. The first is obtained by treating commercial litmus with alcohol of about 90 per cent, filtering cold, and boiling the clear tincture; whereupon indigo is precipitated as a fine powder, according to the author. The second body is obtained by evaporating the violet-red mother-liquor; it is a beautiful red, or, from many varieties, green, fluorescent substance, indifferent to acids. The litmus residue left after the above treatment with alcohol, and which is insoluble in that fluid, is digested with distilled water for twenty-four hours, after which the deep-coloured solution is evaporated to dryness on the water-bath, the residuary extract treated several times with absolute alcohol containing a little glacial acetic acid and again evaporated, until it forms a brown powdery mass. This brown powder is now extracted with absolute alcohol and acetic acid, whereby a large quantity of a scarlet-red body is dissolved, which resembles orceine and becomes purple-red, in place of blue, with ammonia. The portion of the brown powder insoluble in the acidified absolute alcohol consists of the litmus colouring matter in a state of great purity—so pure, in fact, that by means of it the carbonated alkaline earths contained in spring waters may be titrated with as great delicacy as by the use of cochineal tincture, which is far from being the case with crude litmus.

To get this perfectly pure, it is first washed with absolute alcohol, then dissolved in a small quantity of water and thrown into a large excess of alcohol; the flocculent purple precipitate collected and again thoroughly washed with alcohol.

I have repeated Wartha's experiments as here stated upon some samples of litmus obtained from Bullock and Crenshaw, of Philadelphia, and said to have come from Pettitt, Aimee, and Co., Paris, France. My observations confirm his results in every particular, save as regards the indigo. No deposit of indigo was obtained upon boiling the alcoholic tincture, not even after repeated ebullitions, with intervals of rest and cooling.

The fluorescent body which he mentions is violet or purple, as I have obtained it, and gives a solution in alcohol of a similar colour, which shows a beautiful green fluorescence with sunlight, even when very dilute, and with the spectroscope gives a very characteristic absorption band in the green, together with an almost total absorption of the violet end of the spectrum.

It is soluble in water, amylic alcohol, and common ether to some extent, extremely soluble in alcohol, but seems to be wholly insoluble in bisulphide of carbon, chloroform, petroleum-naphtha, and oil of turpentine, imparting neither colour nor fluorescent property to those liquids.

The solutions in amylic alcohol and in ether both exhibit a beautiful fluoresence, but the ethereal solution shows the absorption band in the green only very faintly, even when the solution is thoroughly saturated. The solubility of the substance in both of these liquids is probably due to the trace of common alcohol, which they both contain, as found commercially. The body which resembles orceine shows a very faint fluorescence, and in alcoholic solution gives a spectrum in which the absorption is characteristic, and quite distinct from that of the last. It is slightly soluble in water, very soluble in alcohol, but seems to be insoluble in ether, chloroform, bisulphide of carbon, and petroleum-naphtha.

The pure colouring matter proper of litmus is insoluble in alcohol ether, chloroform, bisulphide of carbon, and petroleum-naphtha, both in the cold and upon boiling; it is very soluble in water, and its aqueous solution yields an absorption spectrum differing from that of each of the preceding substances.

This substance turns blue with ammonia, and seems more like the azolitmine of Kane than either of the other substances, but I obtained no ammonia from it by heating with sodic or calcic hydrates, that is, sufficient to show its presence by odour or by reaction upon reddened litmus paper.

It yields in alkaline solution a beautiful violet lake with alumina, one of a pale violet colour with stannous acetate, and deep blue lakes with calcium and barium.

The residue left, after extracting litmus with alcoh and then with water, is soluble to the extent of 8r

* Read before the American Chemical Society, June 1, 1876.

† Ueber den Lakmusfarbstoff. V. Wartha, *Ber. Chem. Ges. Berlin*, 9, 217.

cent in dilute hydrochloric acid, and the portion dissolved in this liquid consists of calcic and magnesic carbonates, free from colouring matter, in the proportions of about 90 per cent and 10 per cent of the carbonates respectively. The residue, insoluble in dilute hydrochloric acid, consists mostly of fine sand, but yields some colouring matter to strong ammonic hydrate, and forms a solution of a blue colour, with a precipitate, red and gelatinous, somewhat like alumina, upon supersaturation with an acid.

About 25 grs. of the pure colouring matter, 15 grs. of the body like orceine, and 10 grs. of the fluorescent body, were obtained per ounce of litmus.

Diagrams of the absorption spectra yielded by these several substances I reserve for a second paper.—*American Chemist.*

NOTES ON MINERAL ANALYSES.

By W. M. HUTCHINGS.

The accompanying analyses of chrysocolla and copper-pitchblende (*Kupferpecherz*) may prove of interest to some of the mineralogical readers of the Chemical News.

The minerals are from Mexico and are imported into England in considerable quantity for copper smelting. The specimens analysed were very pure and homogeneous pieces, sought out from among a large quantity of freshly broken lumps of ore. The two minerals occur so thoroughly intermixed that it is difficult to find a piece of any size of either of them free from the other; so that it was necessary to break up the best pieces into fragments, picking out with forceps those which were perfectly pure of either kind.

The chrysocolla is light bluish green in colour; hardness, 4·0. The copper-pitchblende is dark brown—almost black—with hardness 6·0. Large amounts of gypsum and clay occur with this ore. Copper carbonates are only present in small quantity here and there. When large lumps are broken open they often show drusy cavities in which the chrysocolla occurs botryoidal. This botryoidal chrysocolla is always coated over with a thin layer of quartz—sometimes amorphous, but more usually beautifully crystallised in very minute crystals.

The powdered minerals were dried at 95° C. for some hours previous to analysis.

Analysis of Chrysocolla.

	Per cent.
Silica, soluble in Na_2CO_3	62·42
Silica, insoluble in Na_2CO_3	3·83
Copper oxide	25·69
Lead oxide	0·12
Ferric oxide	0·26
Zinc oxide	0·34
Lime	0·74
Magnesia	1·06
Water	6·13
	100·59

With traces of cobalt and manganese.

Analysis of Copper-pitchblende.

	Per cent.
Silica, soluble in Na_2CO_3	20·63
Silica, insoluble in Na_2CO_3	7·35
Copper oxide	28·59
Lead oxide	0·41
Ferric oxide	10·94
Alumina	0·15
Manganous oxide	17·53
Oxygen	3·60
Cobalt oxide	0·35
Zinc oxide	1·54
Lime	0·92
Water	8·30
	100·31

Laboratory, Wallasey Ore Yard, Birkenhead

AN IMPROVED FORM OF ASPIRATOR.

By R. H. RICHARDS.

The arrangement of this improved form of aspirator is shown in the figure.

A glass tube should be bent of the form represented. This is essential, as it serves to break up the water jet into foam and thus start the suction.

I find a hydrant pressure of about 20 pounds on the square inch, equivalent to 40 or 50 feet column of water, will easily exhaust to within 1 m.m. of the tension of aqueous vapour, and will cause a flask of water to effervesce as the dissolved air is disengaged.

NOTICES OF BOOKS.

Massachusetts Institute of Technology. President's Report for the Year ending September, 30, 1875.

This establishment continues to be efficiently and successfully conducted. Turning, as a matter of course, to the "Department of Chemistry," we learn that "in the laboratories for quantitative analysis there has been a large and enthusiastic class," and that "the quality of the work done has, as a rule, been good." A variety of improvements and additions have been made. Thus "a careful selection of substances, the analysis of which would give an appropriate analytical training for any branch of chemistry, has now been made." Extra balances have been procured, Bunsen pumps have been replaced by Richard's "jet aspirators," and a modification of the same arrangement is used to supply air to the blast-lamps. The facilities for organic and volumetric analysis, and for the determination of copper in ores

alloys by means of electro-deposition, have been extended. A small room has been set aside for chemico-optical work, and fitted with a large reflecting goniometer, a Landolt's optical circle, a Browning's spectrometer, a large direct vision spectroscope by Zeiss, a large inverted microscope, a smaller microscope, and three dissecting microscopes by Zeiss and Toller, and a saccharimeter by Soleil.

It may be interesting to the heads of colleges and scientific institutions in this country to note the list of desiderata which Prof. Wing still considers needful before the chemical department of the Institute can be pronounced satisfactorily provided for:—

"The instruction in chemistry is much hampered by the want of a laboratory for qualitative analysis apart from the laboratory used for instruction in general chemistry; of a laboratory for organic chemistry; of a laboratory for applied chemistry; of a suitable reading room where the books of the chemical library may be consulted and writing done; of a number of small rooms for the use of special apparatus."

We regret to learn from a foot-note that the balance-room with its contents and the collection of substances for analysis have been destroyed by fire, and the library very much damaged. We have no doubt that many chemists in this country who have on hand substances of known composition would be happy to assist in restoring the lost collection if some channel were pointed out.

Amongst the theses presented by graduates, we find only one which can be pronounced strictly chemical, *i.e.*, a paper on "Anthracen Pressings," by L. P. Kinnicutt. The subject is highly interesting, but the abstract given is so exceedingly brief that no opinion can be formed as to the merits of the essay.

It must be remembered that in addition to the chemical department, or as we would rather say, faculty, chemistry forms a feature more or less prominent in the courses of mining, engineering, metallurgy, physics, natural history, and general science. Five professors and as many assistants are occupied with various phases of our science.

As a novelty we may point out the introduction of "military science and tactics" as a regular feature in all the departments. Were any of our English colleges or scientific institutions to take a similar step it would be incontinently stormed, sacked, and burnt to the ground by our advanced humanitarians, who protest even against the introduction of military drill into elementary schools.

The Constants of Nature. Compiled by F. Wigglesworth Clarke. Washington: Published by the Smithsonian Institution.

We have here a continuation of this valuable series of tables. The first supplement to Part I. is devoted to specific gravities, boiling-points, and melting-points. Part II. is occupied with the specific heats of solids and liquids; whilst No. III. comprises tables of the expansion of solids and liquids by heat. We need not say more than that the undertaking is equally laborious and praiseworthy.

CORRESPONDENCE.

SUSPENSION OF CLAY IN WATER.

To the Editor of the Chemical News.

Sir,—Numerous contributions on this subject to the Chemical News have appeared since mine in 1866, but I do not find anything new in them, with the exception of that by Mr. W. Durham, F.R.S.E., who discovers the fact that alkalies and their carbonates in small quantity prevent the coagulation and precipitation of clay suspended in water. I consider this as an interesting discovery, and one that may enable us to explain the persistent suspension of clay in what we take as *pure* water. For instance, the purest water we would take for experiments of this sort contains ammonia, either free or as carbonates. Why not, therefore, suppose that this ammonia forms a compound with the silica of the suspended clay, resembling soap in type of constitution, silica of course corresponding with the fatty portion of such substances. As is well known, all soaps deport themselves like clay with regard to the phenomena under consideration.

I would like to know the deportment of *pure* water with *pure* hydrous silicate of alumina in regard to the question under consideration. Clay seems *permanently* suspended in strong ammonia.—I am, &c.,

William Skey.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances, de l'Academi des Sciences. No. 9, August 28, 1876.

Sixth Note on Electric Transmissions through the Soil.—M. Th. du Moncel.—From the experiments described it appears that under the most favourable conditions the resistance of the soil varies from 4 to 5 kilometres of telegraphic wire, and that it is consequently far from being *nil*, as has been commonly asserted. If wells or other stores of water do not intervene the resistance may be sometimes enormous.

Alcoholic and Acetic Fermentation of the Fruits, Flowers, and Leaves of certain Plants.—S. de Luca.—In close vessels fruits keep for a greater or less length of time, whether in hydrogen or carbonic acid, or in a vacuum, or in a limited quantity of air. In such conditions fruits undergo a slow fermentation, with development of carbonic acid, nitrogen, and, in some cases, hydrogen, and with formation of alcohol and acetic acid without the intervention of any ferment. In closed vessels these phenomena are produced imperfectly on account of the strong pressure produced by the gases evolved. Leaves and flowers behave like fruits in a limited atmosphere, either of carbonic acid, hydrogen, or air, in a vacuum or in sealed vessels.

Moniteur Scientifique, du Dr. Quesneville, August, 1876.

Salicylic Acid in the Milk Trade.—Drs. L. Manetti and G. Muso.—The authors recommend the use of salicylic acid for the preservation of cream in small farms where butter is made only a few times in the week, and for the preservation of butter where there is no convenience for storing it in places at a temperature not higher than 6° to 8° C., as well as to keep it from rancidity when forwarded during the summer season to distant markets.

Researches on Viscous Fermentation.—A. Commaille.—Not suitable for abstraction.

Study on Coffee.—A. Commaille.—The author has endeavoured to ascertain if it is possible to class coffees by analysis, as the brokers, merchants, and experts do by certain outward characteristics or by taste. In this attempt he does not consider that he has been successful.

History of the Manufacture of Turkey-Reds.—Theodore Chateau.—A continuation; unsuitable for abstraction.

Constitution of the Derivatives of Benzin.—M. E. Nolting.—A lengthy treatise, containing a large amount

of hypothetical matter, somewhat *naïvely* ushered in with the confession that "not merely the practical man, but even the theoretical chemist, has difficulty in finding his way across the labyrinth of memoirs and dissertations, and in extricating himself from the chaos of contradictory hypotheses!"

New Class of Colouring Matters.—M. Ch. Lauth.—The raw materials employed for obtaining these new products are the aromatic diamines obtained on reducing the nitro-derivative from the acetylisation of organic bases. Thus, taking aniline for an instance, acetanilide is first prepared, then nitracetanilide and nitraniline; then the nitraniline is reduced either by iron and acetic acid, or by tin and hydrochloric acid. In the first case it is necessary, when the reaction is completed, to add to the mixture an excess of lime and to distil, obtaining thus β-phenylen-diamine, which a single rectification yields perfectly pure; in the second case we obtain a liquid, from which the tin is removed by zinc, and this mixture may serve at once for the production of the colouring matter, as will be at once explained. The various isomeric diamines have been studied for a long time with the object of turning them to account in the production of colouring matters: the aniline-brown obtained by the action of nitrous acid upon α-phenylen-diamine is the only interesting product hitherto obtained. We arrive at different results if we begin by introducing into the β-phenylen-diamine a new element, sulphur. This β-phenylen-diamine may be obtained by heating the diamine with its own weight of sulphur to 150° to 180°, when an abundant escape of sulphuretted hydrogen occurs. When the reaction is at an end, the mass is treated with hot dilute hydrochloric acid, and filtered to remove excess of sulphur. The liquid thus obtained gives splendid violet-blue colours with oxidising agents. It is, perhaps, more advantageous, and certainly more expeditious, to produce the sulphuration and oxidation in a single operation. For this purpose the hydrochloric solution of the phenylen-diamine is saturated with sulphuretted hydrogen (and we may, in this case, utilise directly the liquid containing zinc mentioned above), and we add perchloride of iron; the sulphur liberated combines in the nascent state with the base, and if the addition of the oxidiser is continued little by little the colouring matter is developed and precipitated. It is filtered, washed with slightly saline water to eliminate certain impurities, dissolved in boiling water, and let cool, when it is obtained pure in splendid crystals. The following are the proportions employed:—To 20 grms. of hydrochlorate of phenylen-diamine—Water saturated with sulphuretted hydrogen, 4000 c.c.; hydrochloric acid, 20 grms.; perchloride of iron in solution at one-tenth, 500 c.c. The new violet is a beautiful dye, giving very pure shades, much more blue than can be obtained with Paris violet of the bluest quality, and it preserves its special tone by artificial light. It is very soluble in boiling water, but the smallest trace of foreign matter modifies its solubility. The alcoholic solution is redder than that in water, and is dichroic. The solution in alcoholic soda is of a splendid magenta-red. Soda added to the solution of the violet gives a brown precipitate, the base of the new colouring matter; ammonia and acids give a violet precipitate, soluble in an excess of acid. The acetic solution is violet; that in mineral acids a fine pure blue; on dilution with water it is re-precipitated. Metallic salts give precipitates which re-dissolve when the salt has been eliminated by washing; chloride of zinc gives a very bulky amaranth-red precipitate; chloride of sodium separates the violet from its solutions, but converts it partially into a new violet substance insoluble in water. If this precipitation is several times repeated the transformation is complete, and the soluble colouring matter disappears entirely. Boiling with salt water gives rise to the same reaction. Tannin forms with the violet a compound insoluble in water. Reducing agents completely decolourise the solutions of this dye, but the colour returns on exposure to the air. Oxidising agents also destroy it rapidly. The new colour, like most of its congeners, is capable of yielding other colouring matters by substitution; if heated with aniline it yields a blue soluble in alcohol, but insoluble in water; if submitted to the action of aldehyd, iodide of methyl, &c., under ordinary conditions it is transformed into blues of a more and more green tone, but of great purity, and which present the remarkable feature that they are soluble in water, and may be fixed in dyeing by merely immersing the fibre. The colouring matter just described has been obtained with β-phenylen-diamine; if we set out from pseudo-toluydin we obtain a violet much redder, and crystalline toluydin yields a violet-red. It is very probable that in the same circumstances other organic bases will likewise produce colouring matters. Sulphur, then, may play a part in the formation of colouring matters, and as it is permissible to suppose that other simple bodies possess analogous properties, the field of research is indefinitely extended.

Ferments and Fermentations.—M. Charles Blondeau.—Unsuitable for abstraction.

Les Mondes, Revue Hebdomadaire des Sciences, No. 16, August 17, 1876.

Soap obtained directly from Salt.—If tallow, oil, and resin, the matters commonly employed in soap-making, are heated with an excess of common salt, ammonia, and water, a soda-soap separates, leaving in the liquid chloride of ammonium along with the excess of free ammonia and salt. This reaction is due to the greater solubility of ammoniacal soap in ammoniacal water, and the insolubility of soda-soap in water containing ½ per cent of salt. At first the ammonia combines with the fatty acids, then the sodium contained in the salt takes the place of the ammonia in the soap. An excess of ammonia and soap is essential. 100 parts of tallow require 15 or 20 parts of ammonia, 20 to 30 of salt, and 200 to 300 parts of water (Whitelaw in *Chemischen Centralblatt*).

No. 17, August 24, 1876.

A fall of meteoric stones took place near Ställdalen, in Sweden, June 28, between 11 and 12 a.m. Twelve fragments have been found, one of which weighs 4½ lbs. A spectator affirms that a very intense whistling was heard, accompanied by a light which was very distinct, though the day was clear and cloudless. Two very loud explosions were heard, succeeded by one less violent, after which eight or ten persons saw the meteorites fall.

The Radiometer of Mr. Crookes.—A memoir read before the Academy of Padua by Prof. F. Rosetti.—The author concludes his paper as follows:—"After the exhibition which I have performed you will be convinced that the radiometer is not an instrument destined merely to attract general attention by reason of its novelty and the curious phenomena which it presents, but that it may serve as a prompt and sensitive thermoscope, and, if used with proper precautions, also as a photometer. It is a novel acquisition for science, both from a theoretical and a practical point of view, and as such it is is capable of many applications." The author then describes a modification of the instrument for the purpose of registering the intensity of the solar radiations.

Movements Produced by Light and Heat, and on the Radiometer of Mr. Crookes.—Dr. A. G. Bartbi.—A luminous or thermic pencil which falls upon any body produces a movement due to four causes—(1) Action of the heated sides. (2) Currents of air produced around the heated body itself. (3) Reaction of gases or vapours liberated by heat. (4) Reaction of air heated by contact with the surface upon which the rays fall. On suppressing these causes in the best possible manner, incident light was no longer found to produce attraction or repulsion. These results, however, do not prove that a very feeble impulsive action is not exerted by heat or light.

Bulletin de la Société d'Encouragement pour l'Industrie Nationale. No. 33, September, 1876.

Report Presented by M. F. Le Blanc on behalf of the Committee of Chemical Arts on a New Apparatus for the Condensation of Liquefiable Matters Held in Suspension in Gases or Vapours.—MM. E. Pelouze and P. Audoin.—This apparatus cannot be described in an intelligible manner without the aid of illustrations. (See *Comptes Rendus*, lxxvii., pp. 819 and 928.)

Report Presented by M. F. Le Blanc on behalf of the Committee of Chemical Arts on a New Spectro-Electric Tube or "Fulgurator."—MM. B. Delachanal and A. Mermet.—This interesting paper also cannot be made intelligible without the two accompanying illustrations.

Extraction of Vanillin from the Sap of the Pine.—M. Bouquet de la Grye, on presenting to the Agricultural Society of France two samples of vanillin derived from the sap of the pine, made the following remarks:—One of the samples is vanillin in a pure state, whilst the other is prepared for the uses of the confectioner. Vanillin exists in the sap of the pine (*Pinus sylvestris*) and of the larch. The first attempts at its extraction were made by Hofmann, but on a small scale. The price of vanillin, though high, in consequence of the operations necessary for its extraction and purification, is still lower than that of natural vanilla. The difficulty lies in procuring the sap. For this purpose the trees are felled during the period when vegetation is most active—in May and June—and stripped of their bark. They are then immediately scraped. The product of this operation, collected in vessels of tinned iron, is immediately heated on the spot to prevent fermentation, filtered, concentrated, and allowed to cool and settle. A substance is thus obtained which resembles powdered sugar, and which is known as coniferin. This is a stable compound, and is sent in barrels to Paris, where the vanillin is extracted.

Gazzetta Chimica Italiana.
Anno vi., 1876, Fasc. v. and vi.

Inactive Amylic Alcohol of Fermentation.—Luigi Balbiano.—The author describes sulphamylic acid, and the sulphamylate of baryta, inactive amylic alcohol, inactive amylic chloride, bromide, acetate, and valerate, and inactive valerianic acid.

Alkaloid found in Damaged Indian Corn and in Mouldy Maize Bread.—Prof. T. Brugnatelli and Dr. E. Zenoni.—The authors consider that the alkaloid in question is the cause of the disease known in Lombardy as "pellagra."

Series of Compounds derived from Ammonaldehyd.—R. Schiff.—The author describes the action of ammonldehyd on phenylic essence of mustard, the formation of acetyl-phenyl-thiosinnamin, the action of ammonaldehyd on the allylic and ethylic essences of mustard. The formulæ given are remarkably sensational.

On Gelatin, considered especially in reference to its Reducing Agency.—Prof. G. Bizio.—This paper is chiefly devoted to an examination of the precipitate produced when gelatin dissolved in water is treated with a solution of mercuric chloride in excess.

Emission of Nascent Hydrogen from Vegetables.—Prof. E. Pollacci.—Not adapted for abstraction.

Action of Certain Reagents on the Principal Organic Colouring Matters.—G. Scurati-Manzoni.—An interesting paper, giving the reactions of colouring matters with certain reagents in a series of tables, too lengthy for insertion.

Natural Poisonous Nature of the Human Corpse.—A. Moriggia.—The cadaveric poison may be extracted from the viscera of a body under toxicological examination by methods used for the alkaloids, and may complicate the result.

MISCELLANEOUS.

Trade Report for September, 1876, of Gehe and Co., of Dresden.—This price current of chemicals and pharmaceutical products is preceded by some very sound and judicious remarks on modern trade and its customs. The authors consider that England has set a good example in its recent legislation on the adulteration of food and drugs, and hopes that there will be a return to genuineness and solidity now the whole civilised world has seen, to its horror, the results of unfettered sophistication.

The Carriage of Explosives.—The British Dynamite Company, Limited, Glasgow, have written letters to the Board of Trade on the above subject. These letters are written as a protest against the conduct of certain railway companies and harbour authorities in refusing to convey or receive for storage any explosive which they may notify that they will not receive. The writer points out that most of the leading railway companies refuse to carry dynamite, and hence its manufacture and use in the United Kingdom is virtually prohibited. He maintains that dynamite, according to the evidence of Major Majendie, "is, on the whole, safer to transport than gunpowder packed in barrels." This refusal to convey dynamite he considers a serious injury to the mining industries of the country, and an obstacle in the way of harbour improvements and other engineering works of public utility. A still greater evil is that there are good grounds for suspecting that dynamite and other explosives are surreptitiously conveyed in passenger trains to a serious extent. It has often struck us as a serious inconsistency that while the sale of poisons is placed under very stringent regulations, that of explosives is practically open. Yet explosives may either by accident or by malice give rise to far more serious calamities than the most malignant poison. We think that the sale of explosives ought to be regulated with great stringency, and that no one ought to be allowed to purchase them without giving proof of his identity, residence, of the purpose for which the substance is required, all these points being registered by the dealer. The custom of miners buying their own gunpowder, guncotton, &c., and storing it in their cottages is most reprehensible, and has given rise to many accidents. Explosives needed in mining should be bought by the employer only, who should be responsible for their safe custody and legitimate employment, and should be served out to the workmen as wanted. In the meantime we are very far from approving of the arbitrary manner in which railway companies refuse to carry certain substances, whilst they convey without scruple goods equally dangerous.

KING'S COLLEGE.—EVENING CLASSES.

WINTER SESSION, 1876-77.

The Evening Lectures commence on Monday, October 9th, and terminate in March.

CHEMISTRY—Mr. W. N. Hartley, at 7 o'clock. Mondays and Thursdays. Fee, £1 11s. 6d.

ANALYTICAL CHEMISTRY—Tuesday from 7 to 9. Fee, £2 2s.

St. Mary's Hospital Medical School,

OPEN SCHOLARSHIPS and EXHIBITIONS in NATURAL SCIENCE.

The Examination for 1876 will be held on Tuesday, the 3rd of October, and following days. Candidates are requested to call upon the Dean, at 49, Seymour Street, Portman Square, on the morning of Monday, October 2nd, between the hours of 10 and 1, and to bring with them the necessary certificates.

For further particulars apply to the Registrar, at the Hospital, or to A. B. SHEPHERD, M.B., Dean of the School.

St. Mary's Hospital Medical School.

Paddington, W.

OPENING of WINTER SESSION, October 2nd, 1876.—Introductory Address by Dr. Wiltshire.

SCHOLARSHIPS in Natural Science, Classics, and Mathematics, varying in value from £120 to £20. For further particulars apply to the Dean.

A. B. SHEPHERD, M.B., Dean of the School.

THE CHEMICAL NEWS.

Vol. XXXIV. No. 880.

NOTE ON SOME NEW DERIVATIVES OF ANTHRACEN.*

By W. H. PERKIN, F.R.S.

Anthracen when treated with chlorine or bromine, under ordinary circumstances, yields dichlor- or dibrom-anthracen, even if the hydrocarbon be used in excess. This was shown by Graebe and Liebermann, who found that by treating anthracen under carbon disulphide with only one molecule of bromine, dibrom-anthracen resulted. Dr. Anderson has described, however, a dichloride of anthracen, and also a monochlor-anthracen. There can be no doubt, from the way he produced these bodies, that the first was only ordinary dichlor-anthracen, and the latter I am inclined to believe was a mixture of anthracen and dichlor-anthracen.

I thought under these circumstances it would be of interest to make further experiments on this subject, and see if it were possible to obtain some definite monoderivatives containing chlorine or bromine.

Dibromide of Anthracen.—A one per cent solution of pure anthracen in carbon disulphide cooled to within a degree or two of 0° C. when mixed with the theoretical quantity of bromine dissolved in carbon disulphide, and also cooled with ice, gives a reddish brown fluid, which gradually becomes nearly colourless, and at the same time small white brilliant crystals are deposited: these, when collected, were washed with anhydrous ether, and allowed to dry spontaneously or under the air-pump. They decompose, however, rapidly, and hence good numbers could not be obtained on analysis; but the following combustion, taken in connection with the other facts relating to this substance, shows that it is a dibromide of anthracen.

	Theory for $C_{14}H_{10}Br_2$.	Experiment.
Carbon	49·70	48·85
Hydrogen	2·95	3·04

Dibromide of anthracen crystallises in flat oblique prisms, which quickly become yellow and opaque at the ordinary temperature with evolution of hydrobromic acid. This decomposition takes place very rapidly if heat be applied. It is difficultly soluble in alcohol, ether, and carbon disulphide. It yields anthraquinon on oxidation.

Monobrom-anthracen.—This substance is formed when the dibromide is kept at the ordinary temperature, or better when it is heated; thus—

$$\underbrace{C_{14}H_{10}Br_2}_{\text{Dibrom-anthracen.}} = HBr + \underbrace{C_{14}H_9Br}_{\text{Monobrom-anthracen.}}$$

The fused product is crystallised from alcohol once or twice, and is then pure. It gave the following numbers on analysis:—

	Theory for $C_{14}H_9Br$.	Experiment.	
		I.	II.
Carbon	65·36	65·37	65·66
Hydrogen	3·50	3·54	3·56

It is also produced by gradually adding the theoretical quantity of bromine to a solution of anthracen in carbon disulphide at the ordinary temperature, and may also be obtained from the mother liquors from the dibromide of anthracen by distilling off the carbon disulphide and crystallising the residue fractionally; but in both these cases it is difficult to obtain in a pure condition, as it is usually mixed with anthracen and dibrom-anthracen.

Pure monobrom-anthracen fuses at 100° C. It is easily soluble in benzol and carbon disulphide, and moderately soluble in alcohol, more so than dichlor-anthracen. It also dissolves in glacial acetic acid. It crystallises in long yellow needles. In fuming sulphuric acid it dissolves with a dirty yellowish green colour, addition of water causing a brown precipitate to separate. When its benzolic solution is mixed with a similar solution of picric acid it becomes red, and on evaporation deposits orange-red crystals of the new compound not unlike sublimed alizarin.

Dichloride of Anthracen.—When about the theoretical quantity of chlorine is gradually passed into a one per cent solution of anthracen, cooled to about 0° C., a white crystalline product separates out. This is the dichloride: it is even more unstable than the dibromide, giving off hydrochloric acid rapidly at ordinary temperatures, and still more quickly when heated. It was therefore impossible to analyse it, but from its decomposition into monochlor-anthracen there can be no doubt about its formula being—

$$C_{14}H_{10}Cl_2.$$

This substance is difficultly soluble in alcohol, ether benzol, acetic acid, and carbon disulphide.

Monochlor-anthracen.—This is best obtained by fusing the dichloride, the reaction being—

$$\underbrace{C_{14}H_{10}Cl_2}_{\text{Dichloride of anthracen.}} = HCl + \underbrace{C_{14}H_9Cl}_{\text{Monochlor-anthracen.}}$$

The product is purified by crystallisation from alcohol, from which it is deposited in golden yellow flat needles, often of considerable length. It may also be obtained from the mother-liquors of the dichloride, which, however, usually contain a good deal of dichlor-anthracen. It gave the following numbers on analysis:—

	Theory for $C_{14}H_9Cl$.	Experiment.	
		I.	II.
Carbon	79·05	78·62	78·75
Hydrogen	4·23	4·22	4·52

Monochlor-anthracen fuses at 103° C. It is very easily soluble in ether, benzol, and carbon disulphide. It is also easily soluble in alcohol, and moderately so in glacial acetic acid. It dissolves in fuming sulphuric acid with a green colour: addition of water to this solution gives a brown precipitate, but if the sulphuric solution be heated it turns brown, and is then not precipitated on addition of water, and seems to consist of disulpho-anthraquinonic acid. Like monobrom-anthracen, it produces a compound with picric acid, which crystallises in most beautiful tufts of scarlet needles.

* Read before the British Association, Glasgow Meeting (Section B.)

ON THE PROXIMATE COMPOSITION OF COAL-GAS.*

By W. DITTMAR,
Professor of Chemistry in the Andersonian University, Glasgow.

In a memoir, "Sur le Gaz d'Eclairage," which he published some months ago in the *Comptes Rendus*, M. Berthelot reports on a most elaborate proximate analysis of the Paris gas, which brought out the startling result that that gas contained only 3·7 per cent of heavy carburetted hydrogens, and that these 3 7 per cent included of—

Benzol	3·0 to 3·5 per cent.
Acetylen	0·1 ,,
Ethylen	0·1 to 0·2 ,,
Propylen and other hydrocarbons	0·02 ,,

* Read before the British Association, Glasgow Meeting (Section B.)

In other words, the gas was found to contain only about $3\frac{1}{2}$ per cent of things *not* diluents, and that these $3\frac{1}{2}$ per cent consisted substantially of benzol only. Regarding the experimental evidence adduced, it may suffice here to state that the sum total of heavy carbides was determined by absorption with bromine, and that the volume of the benzol vapour was identified with the contraction suffered by the gas when shaken with fuming nitric acid.

From the numbers just quoted it would appear that the Paris gas, as analysed by Berthelot, has quite an exceptional composition, owing perhaps to an exceptional mode of manufacture. This, however, is not the view which Berthelot takes of the matter. He does not hesitate to extend his results as applying substantially to *illuminating gas in general*, these results, he says, being in perfect accordance with what he had found out long ago regarding the pyrogenic relations of carburetted hydrogens.

Now it so happened that at the time when Berthelot's memoir reached me I was just engaged in collecting materials and apparatus for investigating, by synthetical methods, into the extent to which the several constituents of a coal-gas contribute to its illuminating power: I accordingly read Berthelot's paper with the greatest possible interest, and at once decided upon looking into the matter.

I will begin by offering some remarks on the manner in which Berthelot tries to account for the fact that all previous coal-gas analysts, instead of his few per milles, invariably found large percentages—sometimes as much as 10 per cent, and even more—of olefines. Berthelot's explanation is this:—Until now analysts (in attempting to determine the composition of their olefines) have entirely relied on the eudiometric method of combustion, and "la traduction de leurs resultats par les noms de . . . . est absolument erronée comme repasant sur un simple jeu d'equations algèbriques, calculées dans l'hypothèse de certaines inconnues qui ne sont pas conformes à la realité." Now this, I think, is putting it rather strongly. It is quite true that gas analysts hitherto have not always kept quite alive to the obvious proposition that the combustion of a gas cannot by any means give us more than the quantitative elementary composition of the unit volume, and that consequently the reporting of so-and-so many per cents of ethylen, butylen, &c., is nothing more than a rather clumsy *modus* of stating the volumes of carbon-vapour and hydrogen in the part condensable by bromine or by fuming oil of vitriol. But is it possible to assume that in the many coal-gas analyses which have been published by Bunsen, Landolt, Frankland, and others, the numbers which to these chemists served as a basis for their calculations should have been so entirely wrong as to enable them to turn into C_nH_{2n} what in reality consisted mainly of C_6H_6?

Let us look at an example. Bunsen, in his "Gasometric Methods," gives all the details of a complete analysis of a sample of Manchester coal-gas, in which his "ethylen" and "ditetryl" (C_4H_8) were calculated from the following data:—(After removal of H_2S and CO_2) 11·1 vols. of tho gas gave up to fuming oil of vitriol 0·747 vol. To determine the carbon and hydrogen in this 0·747 vol. two combustions were made, viz., one of the original gas, and, secondly, one of the part not condensable by SO_3; and from the result it appeared that the "olefines," if burned by themselves, would have given—

A contraction of 1·747 vols.
CO_2 ,, 2·089 ,,

Now these numbers show that, whatever may have been its *proximate* composition, the elementary composition of the "olefine" was $C_{1\cdot05}H_2$ = say 0·75 vol. (which is near enough), and, neglecting the small excess in the carbon, we see that these numbers agree with the hypothesis that the absorbed gas consisted of—

C_3H_6 = 2 vols of propylen, and
$\frac{1}{3}C_2H_4$ = 1 vol. of ethylen.

It is true there *is* room for a little benzol. To find a maximum limit for this potential benzol, let us assume the observational errors had made the carbon too high and the hydrogen too low, and take $x = 1\cdot1$ and $y = 1\cdot8$, instead of 1·05 and 2·00 respectively. If we do so we find—

Benzol .. 0·13 vol.
Olefines .. 0·62 ,, } or $C_{2\cdot26}H_{4\cdot52}$ in 2 vols.
containing $C_{0\cdot7}+H_{1\cdot4}$ }

We see that what was put down by Bunsen as so much of a mixture of C_2H_4 and C_4H_8 could not well be assumed to have contained much above 17 per cent of benzol.

No doubt if we went to the trouble of re-calculating, in a similar manner, the coal-gas analyses executed after Bunsen's method by Frankland, Landolt, &c., we should arrive at similar results. I prefer passing now to a series of experiments which I made for ascertaining to what extent Berthelot's views hold with regard to Glasgow coal-gas.

The first experiment I made was to pass a current of the gas through a long column of nitric acid, of 1·5 sp. gr., into a glass gas-holder, and then to compare the illuminating power of the product with that of the original gas, a "fish-tail" burner being used in both cases. The flame of the de-benzolated gas was only very feebly luminous, which, at the time, I felt inclined to accept as strong evidence of the absence in the gas of any considerable quantity of olefines; but not feeling quite sure on this point I tried some experiments on the luminosity of synthetically prepared mixtures of hydrogen and ethylen. To my surprise I found that the addition (to 1 vol. of C_2H_4) of only 3 vols. of hydrogen sufficed to bring down the luminosity to about the level of marsh-gas, while a 10 per cent ethylen flame was no more luminous than that of a Bunsen's lamp! On the other hand, a mixture of *benzol-vapour* and hydrogen, which (by combustion of a measured volume with oxide of copper) had been proved to contain 3 per cent of benzol-vapour (equal in carbon to only 9 per cent of C_2H_4), was found to give a brilliantly luminous flame.

These results render it highly probable that the light-value of a coal-gas depends far more on the proportion of benzol than on the proportion of olefines contained in it. This, however, has nothing to do with the question on hand. More nearly related to it is an observation which I made incidentally in preparations of benzolated hydrogen. The 3 per cent gas above referred to had been made by passing hydrogen slowly through a bulb apparatus charged with benzol, and kept at about 18° C. From the bulb apparatus the gas was made to bubble up through water into a gas-holder. Now, according to Regnault's tension determinations, the gas should have contained about 10 per cent of benzol-vapour, and yet it contained only 3 per cent. I could not explain this otherwise than by supposing that the greater part of the vapour originally present had been dissolved out by the water in the gasometer. To test this hypothesis a quantity of benzolated hydrogen, kept over mercury, and proved by combustion to contain 6 per cent of C_6H_6, was shaken with water and again analysed. The percentage of benzol-vapour was reduced to less than 2.

After these experiences I felt convinced that, although coal-gas as it comes out of the retort cannot help containing a considerable proportion of benzol, only very little of this vapour will survive the subsequent processes of purification. And having previously found that Glasgow gas when shaken with bromine contracts about 10 per cent, I had no doubt in my mind that the greater part of this contraction must be owing to olefines.

Wishing to determine the exact ratio in the gas between the benzol and the olefines, I tried very hard to find out a quantitative method for their separation from each other; but I did not succeed. That *nitric acid* of 1·5 is *not* the proper reagent for the purpose a few experiments were sufficient to show—some made with pure ethylen, others with synthetically prepared mixtures of this gas with ben-

zolated hydrogen of known composition. In all cases the acid was found to act on the ethylen as well as on the benzol; no doubt with formation of Kekulé's—

$$C_2H_4\begin{cases}NO_2\\NO_2\end{cases};$$

and equally unfavorable results were obtained when 1·4 acid was substituted for the 1·5. For a time I thought an approximate separation, at least, could be effected with fatty oils or heavy paraffin-oils, but it turned out an illusion; a considerable quantity of ethylen always accompanied the benzol in its absorption by these liquids.

The last substance I tried was non-vulcanised india-rubber, and, if I may trust a few preliminary trials, it *does* seem to have the power of abstracting the benzol from a gas without condensing much of the ethylen. I have, however, not yet found the time for trying *exact* quantitative experiments.

In order to form an idea of the proximate composition of the olefine portion of Glasgow gas, a current of it was made to pass (1) over dry chloride of calcium, (2) over a coil of sheet india-rubber, and (3) through a long slanting tube charged with bromine. The bromine soon got almost entirely converted into a liquid bromide, which was washed with dilute caustic soda, dried with fused chloride of calcium, and distilled. A *considerable* portion distilled below the boiling-point of propylen bromide (142°). The percentage of bromine was found to be 83·52, whence, assuming the composition to be $C_nH_{2n}Br_2$, we have—

$$C_nH_{2n}=31·6;\ C_2H_4=28;\ C_3H_6=42.$$

When a weighed quantity was treated on a water-bath with alcoholic potash, a large precipitate separated out, which was found to contain more than half of the bromine originally present in the substance.

These experiments clearly show that the substance consisted substantially, *not* of mono-bromo-benzol (C_6H_5Br, which is *not* decomposable by alcoholic potash), but of bromides, $C_nH_{2n}Br_2$, in which the lowest term, $C_2H_4Br_2$, must have been very largely represented.

From the foregoing it is clear that, contrary to Berthelot's assertion, the constitution of the heavy carburetted hydrogen portion in coal-gas is pretty much what it has always been supposed to be.

I have to thank my friend Mr. W. J. Curphey for the excellent manner in which he has assisted me in this little investigation.

Anderson's University, Glasgow,
September, 1876.

NOTE ON A NEW CORNISH MINERAL.

By FREDERICK FIELD, F.R.S.

Mr. Talling, of Lostwithiel, Cornwall, called my attention to a highly crystallised and very beautiful Cornish mineral which is quite new to mineralogical science. Its crystallisation appears to be rhombic; it is transparent and brilliant, of a clear green colour; hardness about 3·5. It is perfectly soluble in dilute hydrochloric acid, forming a nearly colourless solution. On heating a little over 100° C., the crystals lose water, and at a low red heat at once become brilliantly black. They decrepitate strongly.

Analysis proved the existence of phosphoric acid, ferrous oxide, and water in the proportions that would lead to the formula—

$$3FeO,P_2O_5,4H_2O.$$

From the great scarcity of the mineral only small quantities can be obtained for analysis, and this brief description must be regarded merely as a preliminary note on a mineral of great beauty and interest.

October 3, 1876.

EVOLUTION OF ANTIMONY FROM STIBNITE BY NASCENT HYDROGEN.

By WILLIAM SKEY,
Analyst to the Geological Survey of New Zealand.

The fact that Prof. Storer* has based a method for the direct determination of lead in galena upon the deportment of this ore with zinc and hydrochloric acid, discovered by me in 1870†, induced me to further investigate decompositions of this nature, and the results of this show that stibnite, in contact with zinc and hydrochloric acid, instead of evolving HS as when zinc is omitted, evolves HSb only, that is, at least, during the earlier part of the time in which decomposition is going on. Mispickel, in like manner, first gives off HAs.

It will be seen, therefore, that metallic sulphide can be directly tested for either of these metals in the way indicated above, in conjunction, of course, with slips of paper moistened with a lead salt, and other slips moistened with a silver salt.

For experiments of this kind it is best to use the acid weak, the zinc amalgamated, and the ore coarsely crushed

* "Select Methods of Analysis," by W. Crookes, F.R.S., p. 214.
† *Phil. Trans. of New Zealand Institute*, vol. iii., p. 222.

NOTES OF WORK BY STUDENTS OF PRACTICAL CHEMISTRY IN THE LABORATORY OF THE UNIVERSITY OF VIRGINIA.

No. V.

Communicated by J. W. MALLET,
Professor of General and Applied Chemistry in the University.

(1.) *Analysis of the Ash of the Ground-Pea (Arachis Hypogœa) as Cultivated in Virginia.* By William G. Brown, of Albemarle Co., Virginia.

The pea-nut, also known by the trivial names ground-pea, gouber-pea, and pinda, is a plant cultivated pretty largely in the south-eastern counties of Virginia, near the sea-coast, and in the adjoining part of North Carolina. The nuts, developed on a slender underground stem, are shipped to various parts of the country and sold to be eaten as a sort of cheap luxury after they have been roasted like chestnuts. In France they are extensively employed in making by expression a fine, bland oil, the supply being brought chiefly, if not solely, from the West Coast of Africa and Algiers. The haulm forms excellent forage for cattle. The oil has been the subject of chemical examination by Goessmann and others, but the only record of any study of the plant itself seems to be that contained in the "Report of the United States Department of Agriculture" for 1870 (p. 92), with the quotation there made from the "Transactions of the Highland and Agricultural Society of Scotland" (vol. vi., p. 556). Dr. Antisell, Chemist to the Department of Agriculture, gives merely the proximate composition of the seed and husk in but a rough sort of way, since albuminoid matter and starch are reported together, and the figures given for seed and husk separately will not agree arithmetically with those for the two together, and puts the ash at 1·77 per cent (seed) and 11·90 per cent (husk); saying only as to its composition, that in the case of the seed it consists of salts wholly soluble in water, being phosphates of the alkalies with traces of alkaline chlorides and sulphates, while the ash of the husk contains, chiefly common salt and phosphates of lime and magnesia. The quoted analysis is by Dr. Anderson, also approximate, and applies to the cake or *marc* after expression of the oil. He gives the amount of ash as 3·29 to 3·78 per cent, and says that it contains 1·14 to 1·17 of phosphates and 0·08 to 0·52 of

phosphoric acid. A good and complete analysis of the ash of the different parts of the plant seeming to be worth making, Mr. Brown undertook the work with material obtained by the obliging help of Mr. Jos. van Holt Nash, of Petersburgh, Va.

The plants were carefully taken from the earth when the nuts were just ripe, and sent to the laboratory as gathered. For analysis the root, stem, leaf, husk, and seed were separated, and all visible traces of adhering sand and clay as fully possible removed by brushing and sifting. The seeds used were only such as had ripened perfectly, all shrivelled or unsound kernels being rejected. The method of analysis adopted was uniformly applied to all the parts. The material, air-dried at 15° to 20° C., was cut into small pieces, and, after weighing, burned in a partially covered porcelain crucible surrounded by one of sheet-iron, the latter serving as an air-bath. The heat was gradually applied, and not allowed to attain redness.

The amount of crude ash so obtained, not entirely free from remains of charcoal, was found as follows:—

TABLE I.

(In 100 parts of Air-dried Substance.)

	Root.	Stem.	Leaves.	Husk.	Seed.
Crude ash ..	6·750	7·915	9·932	1·532	1·721

From one portion of this crude ash, carbon dioxide and chlorine were determined. Another portion was treated with dilute hydrochloric acid and evaporated to dryness over the water-bath to render silica insoluble; the residue treated again with hydrochloric acid, warmed with water, and filtered. The residue on the filter consisted of charcoal, silica, and sand; the first was burned off at a low heat, and the second dissolved out by solution of sodium carbonate. From a portion of the filtrate sulphuric oxide was determined as barium sulphate, and after removing this the alkalies were obtained and separated. Another portion of the filtrate was used to determine ferric oxide (precipitated as phosphate from acetic acid solution), and the liquid left on removing this was divided into two parts—one being used to obtain phosphoric oxide by a solution of uranium, while the other gave lime and magnesia. The following results of analysis were obtained:—

TABLE II.

(In 100 parts of Crude Ash.)

	Root.	Stem.	Leaves.	Husk.	Seed.
K_2O.. ..	14·057	17·069	10·948	23·692	36·380
Na_2O ..	11·480	2·019	1·995	2·384	3·274
CaO.. ..	17·160	28·626	37·027	12·763	3·673
MgO ..	5·311	8·762	3·338	8·557	13·792
Fe_2O_3 ..	2·160	0·770	1·845	1·973	0·512
P_2O_5 ..	2·247	1·048	3·225	3·207	28·511
SO_3.. ..	7·940	6·994	10·503	11·245	11·504
Cl	0·708	0·989	1·746	0·308	0·339
SiO_2.. ..	2·260	0·615	0·545	1·269	0·393
CO_2.. ..	17·934	23·893	24·380	26·286	0·868
Sand and charcoal	18·776	9·432	5·098	8·695	0·963
	100·033	100·217	100·650	100·379	100·209
Deduct O equiv. to Cl ..	0·160	0·223	0·393	0·069	0·076
	99·873	99·994	100·257	100·310	100·133

The whole of the potassium and sodium having been calculated as oxides, while a part exists combined with chlorine, a deduction of oxygen equivalent to the chlorine present has been made as above.

The large amount of sandy residue in the roots was owing to the difficulty of thoroughly cleaning their knotted and contorted fibres.

Omitting from the above results the CO_2 and insoluble residue, and calculating the thus purified ash to 100 parts, we get—

TABLE III.

(In 100 parts Pure Ash, including Fe_2O_3.)

	Root.	Stem.	Leaves.	Husk.	Seed.
K_2O.. ..	22·255	25·603	15·466	36·265	36·940
Na_2O ..	18·174	3·027	2·830	3·710	3·325
CaO.. ..	27·168	42·938	52·313	19·537	3·731
MgO ..	8·408	13·143	4·717	13·098	14·187
Fe_2O_3 ..	3·420	1·155	2·607	3·020	0·520
P_2O_5 ..	3·558	1·572	4·557	4·909	28·950
SO_3	12·570	10·491	14·838	17·212	11·681
Cl	1·122	1·483	2·467	0·472	0·344
SiO_2.. ..	3·578	0·922	0·771	1·943	0·399
	100·253	100·334	100·566	100·196	100·077
Deduct O equiv. to Cl ..	0·253	0·334	0·566	0·196	0·077
	100·000	100·000	100·000	100·000	100·000

As the iron may to a considerable extent have come in with the sand as an accidental constituent, the analyses have also been re-calculated, excluding Fe_2O_3—giving the figures in—

TABLE IV.

(In 100 parts Pure Ash, excluding Fe_2O_3.)

	Root.	Stem.	Leaves.	Husk.	Seed.
K_2O.. ..	23·043	25·902	15·880	37·395	37·134
Na_2O ..	18·816	3·063	2·897	3·763	3·342
CaO ..	28·130	43·440	53·712	20·145	3·749
MgO ..	8·706	13·296	4·844	13·506	14·262
P_2O_5 ..	3·684	1·590	4·679	5·062	29·102
SO_3	13·015	10·613	15·235	17·749	11·742
Cl	1·162	1·501	2·533	0·486	0·346
SiO_2 ..	3·705	0·933	0·791	2·003	0·401
	100·261	100·338	100·571	100·109	100·078
Deduct O equiv. to Cl ..	0·261	0·338	0·571	0·109	0·078
	100·000	100·000	100·000	100·000	100·000

It appears from the above results that after deduction of CO_2 basic constituents predominate over acid in the ash of all parts of the plant, largely so in most; and hence salts of organic acids have to a large extent been destroyed during the combustion. Of inorganic salts the sulphates and phosphates of the alkaline and alkaline-earthy metals are the principal—the sulphates being the more abundant in every case except that of the seed. The comparatively small amount of potassium and very large amount of calcium in the leaves is remarkable, as is the unusually large proportion of sodium in the root; this, too, unaccompanied by a corresponding amount of chlorine. Several duplicate determinations were made in the case of the ash of the seed, and these showed as usual that the percentages of the different constituents are subject to a little (but no great) variation; this chiefly extending to the relative proportions of calcium and magnesium, while the united amount was nearly fixed, and to the sulphuric oxide, which, in one instance, fell considerably below the average quantity.

In order to reduce the material examined to a definite condition of dryness, a specimen of each part of the plant was kept at 100° C. as long as it continued to lose weight, with the following results:—

TABLE V.

(In 100 parts Air-dried Substance (as burned.)

	Root.	Stem.	Leaves.	Husk.	Seed.
Moisture lost at 100° C...	9·783	11·484	9·483	9·041	4·892

If, now, the water thus found, together with the sand, charcoal, and carbon dioxide, be deducted from the amount of crude ash, we have,—

TABLE VI.

(In 100 parts dried at 100° C.)

	Root.	Stem.	Leaves.	Husk.	Seed.
Pure ash..	11·830	13·288	7·747	2·586	1·818

Besides thus examining the ash, the percentages of oil and of nitrogen were determined in the seed—the former by repeated and thorough extraction with ether, using atmospheric pressure to force the liquid through a tall percolating tube into a partially exhausted flask, the latter by combustion with soda-lime.

Two specimens of air-dried seed gave 47·34 and 47·44 per cent of oil respectively. This amount is greatly in excess of the figures given in the Agricultural Department's Report above referred to, Dr. Antisell having found only 16 per cent in the Virginia seed, while that of Algerian growth, it is said, on the authority of Dr. Anderson, "furnishes 25 to 27 per cent," to which is probably to be added 6·78 to 12·75 per cent found in the cake.

The nitrogen in the air-dried seed amounted to 3·415 per cent, representing about 22 per cent of albuminoid matter, or nearly the same as in the common pea or bean.

(To be continued.)

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 139.)

Chlorine, Bromine, Iodine, and Fluorine.

By Dr. E. Mylius, of Ludwigshafen.

When, in consequence of the extensive opening of manufactories for the utilisation of the "abraum" salts, an over-production of the salts of potash occurred, other establishments felt induced to enter upon the preparation of bromine, but without accomplishing anything worthy of note in this direction.

Rich sources of bromine were also discovered in North America, and have been worked with great success.

The product, however, does not arrive in Europe as liquid bromine, since ships do not generally receive it among their cargo. It is exported chiefly as bromide of potassium. But considerable as is the quantity of bromine produced in North America there is no foundation for the fear that it may occasion any appreciable depression of the Stassfurt trade, since bromine is obtained in America as a main product, whilst in Stassfurt it plays merely the part of a by-product of the potash manufacture.

The demand for bromine and its compounds depends on its applications in medicine, photography, and scientific chemistry. The hope of seeing its hydrocarbon compounds extensively employed in the manufacture of coal-tar colours in place of the corresponding iodides has not been fulfilled, in spite of the present greatly increased price of iodine. One obstacle which stood in the way of the application of brom-ethyl and brom-methyl for the purpose in question, *i.e.*, the great volatility of these compounds, has been overcome by Dr. A. W. Hofmann,† who proposes to cause bromamyl—which boils at the far higher temperature of 120°—to act upon the coloured bases, to be ethylated or methylated simultaneously with methylic or ethylic alcohol, thus forming brom-ethyl or brom-methyl along with amylic alcohol. Still the small reactive power of the bromides as compared with the iodides, the inferior brilliance of the colours produced with the aid of the former, the difficulty of recovering the bromine as completely as iodine in consequence of its volatility, have prevented bromine from effectively competing with iodine in this department. Still the hope that bromine may on further investigation attain importance in tinctorial chemistry has not been abandoned. Certain manufactories, both English and German, use a mixture of brom-ethyl, which boils at about the same temperature as iod-methyl and brom-methyl. The reporter is informed on good authority that the colour works of Huddersfield and of Barmen still draw large supplies of bromine from Stassfurt.

The use of bromine as a disinfectant in the form of an aqueous solution, introduced during the North American and Franco-Prussian wars, has remained very limited although it possesses several advantages as compared with chloride of lime. In hospitals the use of bromine occasions much less irritation in the respiratory organs than that of chlorine.

Although, as has been stated, bromine finds scarcely any application in great manufacturing operations, its production is still important, as appears from the report of Chandler.* According to this authority 62,500 kilos were annually obtained in North America alone in 1869 and 1870, principally in Tarentum, Sligo, Natrona, Pomeroy, Ohio, and Kanawha. Stassfurt produced in the year 1873, 20,000 kilos.; and England and France together about the same quantity.

From the foregoing it will be readily inferred that there is little novelty in the methods of extracting bromine.

Leisler† took out an English patent for a method of obtaining bromine and iodine. He decomposes the bromiferous lyes with a mixture of hydrochloric acid and bichromate of potash in an iron still furnished with a capital of lead or stoneware. The vapours of bromine along with water are led into a receiver containing iron turnings. Bromide of iron is formed, which dissolves in the water, and is either converted into other metallic bromides by the customary methods, or is treated for free bromine with sulphuric acid and bichromate of potash. This process has never been reduced into practice, and for Germany at least appears too expensive.

In Stassfurt, therefore,‡ the method has been followed which had been used for the extraction of bromine in the salt works of Schönebeck, Artern, and Neusalz, consisting of the following operations:—The mother-liquor of carnallite at 35° B. freed as far as possible from chloride of calcium by refrigeration, is concentrated to 40° B. by further evaporation. According to Frank the concentration cannot be carried so far, as, in consequence of the partial overheating of the lye at the bottom of the pan, bromine is inevitably wasted in the form of hydrobromic acid. On cooling to 25° a quantity of chloride of magnesium, $MgCl_2+6H_2O$, and the remaining mother-liquor contains from 0·3 to 0·5 bromine as bromide of magnesium. It is placed in a sandstone apparatus resembling those used for the preparation of chlorine with the corresponding quantity of manganese and hydrochloric acid, and heated by the introduction of a current of steam. The red vapours which are evolved about a quarter of an hour after the steam is turned on are condensed in a lead worm, cooled in water, and are collected as liquid bromine in Woolff's bottles. The crude bromine is redistilled in glass retorts for further purification. A sandstone apparatus can be charged six times in twenty-four hours. In order to obtain the bromine free from chlorine it is agitated with a solution of bromide of potassium, from which bromine is liberated equivalent to the chlorine present, whilst chlorine of potassium is formed (Falières).

(To be continued.)

* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzehends."
A. W. Hofmann, *Ber. Chem. Ges.* 1869, 441.

* H. Chandler, Chemical News, 1871, No. 585, p. 77.
† L. Leisler, *Dingl. Pol. Journ.*, clxxix., 326. *Wagner Jahresb.* 1866, 170.
‡ F. Michel, *Wagner Jahresbericht*, 1867, 194.

NICKEL AND SILVER ALLOY.

By Major W. A. ROSS.

MESSRS. JOHNSON and MATTHEY, of Hatton Garden, gave me for analysis by the blowpipe some fragments of the result of a fusion together of the metals *silver* and *nickel*, in which the silver (*a*) was on one side, apparently perfectly white and pure, and nickel at the other, of a dark grey colour (*b*).

1. A minute speck of (*a*), treated at the bottom of a phosphoric acid bead in P.P.,* afforded a nearly colourless transparent bead, which, treated with a momentary H.P.,* became covered with the semi-metallic coating on the surface, which shows 5 per cent of the bead to be silver solution.
2. (*b*), in a similar fragment and bead, gave the same reaction, but was *also* nut-brown hot, and orange cold, showing a large proportion of nickel.

It seems, therefore, that nickel in fusion will take up silver to a considerable extent, but that silver refuses to combine similarly with nickel.

October 4, 1876.

ON THE PHYSICAL PROPERTIES OF GALLIUM.

By M. LECOQ DE BOISBAUDRAN.

I HAVE recently prepared rather more than half a grm. of pure gallium. In the liquid state this metal is of a beautiful silver-white, but on crystallising it takes a very decided bluish tint, and its lustre notably diminishes. On properly effecting the solidification of superfused gallium isolated crystals are obtained: these are based octahedra, which I am engaged in measuring.

On a first trial (April, 1876) the point of fusion was found between 29° and 30°, or near +29·5°. I have just examined six samples of gallium *successively* electrolysed from one and the *same solution*. The foreign metals, supposed to be present, ought to distribute themselves unequally among the different fractions collected:—

	Points of Fusion.
Gallium, No. 1.	+30·14°
,, ,, 2.	30·16
,, ,, 3.	30·14
,, ,, 4.	30·15
,, ,, 5.	30·16
,, ,, 6.	30·16
Mean	+30·15°

The sample No. 4 was afterwards placed for two hours in boiling water, and the innumerable globules formed were united by compression. The point of fusion had not varied. The metal was therefore very free from potassium. The six samples of gallium having been mixed, a fragment was taken (weighing 2½ centigrammes), which was kept for half an hour in nitric acid diluted with its own volume of water at a temperature of 60° to 70°. The loss only reached a fraction of a milligramme. The point of fusion remained fixed, for the metal melted *very slowly* at +30·16°, and crystallised *very slowly* at +30·06°. I shall shortly have the honour of submitting to the Academy the new process which served for preparing this gallium, of which the constant point of fusion denotes a very satisfactory purity.

In May, 1876, I tried to determine the density of gallium on a sample of 6 centigrammes: I obtained 4·7 at 15° (and with reference to water at 15°). The mean of the densities of aluminium and indium being 4·8 to 5·1, the provisional specific weight found for gallium appeared to agree tolerably well with a theory placing this metal between indium and aluminium. However, the calculations established by M. Mendeleef for a hypothetic body, which seems to correspond to gallium (at least according to many of its properties), would lead to the number 5·9.

Gallium crystallised under water decrepitates sometimes when heated. Perhaps my first metal contained interstices filled with air or water. I am ignorant if this cause of error is combined with others so as to falsify my first determination. However this may be, I avoided it subsequently by heating the metal strongly and solidifying in a dry atmosphere. I then obtained higher densities, varying from 5·5 to 6·2, although the weight of the trial samples did not exceed a few centigrammes.

I finally operated with 58 centigrammes of gallium derived from the union of six samples mentioned above. Density at +23° (and referred to water at +23°)—

First experiment	5·900
Second experiment	5·970
Mean	5·935

The same gallium was afterwards maintained for half an hour between 60° and 70° in nitric acid diluted with its own volume of water, washed, very strongly heated, and finally solidified in dry air.

Density at + 24·45° (and with respect to water at +24·45°) = 5·956. There is no occasion to insist, I think, on the extreme importance which attaches to the confirmation of the theoretic views of M. Mendeleef concerning the density of the new element.—*Comptes Rendus.*

* See "Pyrology," pages 56 to 58.

NOTICES OF BOOKS.

The Mineralogical Magazine and Journal of the Mineralogical Society of Great Britain and Ireland. No 1, August, 1876. Truro: Lake and Lake.

WE have great pleasure in welcoming the appearance of a magazine specially devoted to mineralogy—a science hitherto not adequately represented in our periodical literature.

The present issue contains the Rules of the Society as adopted at its first meeting, on February 3rd, 1876, and an account of the papers read at the Ordinary Meeting held on February 4th, and at the Local Meeting of the Cornish members at Redruth, July 1st.

These pages comprise a note, by Mr. Marshall Hall, upon a portion of basalt from the Mid-Atlantic, fished up by the steamer *Faraday* whilst grappling for a broken telegraph-cable. The question arises whether the fragment has been wrenched off some submarine ridge, or whether it is an ice-borne mass deposited by an iceberg.

Mr. W. W. Stoddart contributes a paper on the "Occurrence of Celestine in the Keuper Marls, and its Influence on the Composition of Plants." The author has discovered strontia in the ash of eight plants, including the common dandelion and groundsel, found growing on the Keuper marls, on the north-eastern side of Cotham Hill, near Bristol.

Mr. C. Le Neve Foster read a paper on "New Minerals and Mineral Localities in Cornwall and Devon." The species described are—Henwoodite; Pyrophyllite, found for the first time in England at Brookwood Mine; Enysite, from St. Agnes; Actinolite, with green garnets; and Aximite, from S. Terras and South Brent.

Mr. Collins also described Henwoodite and Enysite, and gave a notice of the occurrence of Scorodite, Pharmacosiderite, and Olivenite, in the greenstone at Terras Mine, St. Stephens.

Mr. Vivian communicates a note on "Paragenetic Formations of Carbonate of Lime and Oxide of Iron, and of Quartz and Oxide of Iron, at the Mwyndy Iron-Mines, Glamorgan." Mr. J. H. Collins also furnishes an additional note on the species described by Mr. Vivian.

Mr. C. Le Neve Foster describes and figures a new form

of blowpipe lamp suitable for travellers, and Mr. Dudgeon gives "Historical Notes on the Occurrence of Gold in the South of Scotland."

We believe there is ample scope both for the Mineralogical Society and for its Journal, and we wish them a successful career.

Stanley's Metre-Diagram, Illustrating the Metric System with Explanations, Tables of Length, Surface Capacity and Weight, Rules, Approximate Equivalents, &c. A. and T. W. Stanley, New Britain, Connecticut.

This is a useful pocket companion intended to facilitate an understanding of, and prepare for the introduction of, the metric system of weights and measures. On a folding slip of "artificial parchment," which, by the way, appears to be an excellent material for plans, maps, and the like, requiring to be folded up, is engraved at full size the standard yard of England and America divided into inches and tenths of an inch, Parallel with it is a meter, graduated into decimetres, centimetres, and millimetres, so that the conversion of any lineal measure from the one standard into the other can be effected at a glance. Another diagram, all on the same slip, shows one decimetre with its subdivisions placed side by side with the approximately equal measure of four inches. The remainder of the space is utilised for a brief exposition of the advantages of the metric system, an account of its units, with tables of approximate equivalents, and rules for conversion. The back of the slip is occupied with views of the Philadelphia Exhibition building, with the dimensions stated on both systems.

We heartily wish that some unanimous decision concerning weights and measures could be reached by the civilised world. As regards the metric system England and America seem each to be waiting for the other. A commission of engineers, &c., entrusted by the Franklin Institute with the task of examining into the question, reported against the new weights and measures. One of their arguments was, that as something like three-fourths of the entire foreign trade of America was carried on with Great Britain and its dependencies, the introduction of the metric system would rather hinder than facilitate business.

CORRESPONDENCE.

PROF. DITTMAR AND THE "ANALYST."

To the Editor of the Chemical News.

Sir,—The subject of the recent attack on Prof. Dittmar was brought before the notice of the Glasgow Meeting of the Public Analysts, and the attack was condemned by those present at the meeting. So decided was the expression of condemnation that a vote of censure on the Committee of Publication was even mentioned; but in place of so extreme a course (which in my opinion ought to have been followed) an *indirect* vote of censure was carried, the resolution being to the effect that before commentaries on adulteration-cases are inserted in the *Analyst* the chemists implicated should be communicated with.

I observe that the current number of the *Analyst* purports to give an account of the Glasgow Meeting of the Society, but does not in any way record the resolution passed at that meeting. I observe also an editorial commentary on Mr. Dittmar which is in direct opposition to the resolution passed by the meeting; and I take this opportunity of making known that the Society of Public Analysts has no real control over the *Analyst*, which is the property of Mr. Wigner and Dr. Muter, who alone are responsible for the contents of the paper.—I am, &c.,

J. Alfred Wanklyn.

Laboratory, 117, Charlotte Street, Fitzroy Square, October 2, 1876.

DR. LUNGE'S APPARATUS FOR MAKING CHLORATE OF POTASH.

To the Editor of the Chemical News.

Sir,—In the translation of Dr. Mylius's "Report on Chlorine, &c." (Chem. News, vol. xxxiv., p. 139) there is a quotation from a paper of mine, published nearly ten years ago, which might mislead your readers as well as those of the original German Report. Dr. Mylius quotes my description of a small apparatus for making chlorate of potash as if I had stated that form of apparatus to be in general use in England, whilst the contrary will at once be apparent to any reader of my original paper in *Dingler's Polytechnisches Journal*. The apparatus in question would only suffice (as stated by me) for making 7 cwts. of potassium chlorate per week.

Dr. Mylius also quotes a proposal of mine for obtaining powdered potassium chlorate by disturbed crystallisation. I do not now think that that proposal is worth very much, for, in the first instance, the powder thus obtained would not be anything like fine enough for the users of that article, and would thus have to be passed through a mill anyhow; secondly, manufacturers of that article have always a considerable quantity of siftings from the coarser crystals on hand, which can only be advantageously worked up by grinding them to powder. The danger of grinding potassium chlorate—which I apprehended at that time to be very considerable—I have not, after some years' practical experience, found to be very great, provided the material is kept clear from splinters of wood or bits of iron, and the mill is not allowed to get hot.—I am, &c.,

George Lunge.

Zurich, October 4, 1876.

CALCULUS IN HORSES.

To the Editor of the Chemical News.

Sir,—I have been investigating the nature of the concretions found in the large intestine of horses, and I trust to be able in a short time to communicate to your journal the full details and analyses of these calculi.

In the meantime allow me to observe that we lose a considerable number of valuable horses every year by this terrible disease, particularly those devoted to labour in the iron districts, which animals are generally very fine and powerful, and highly fed. One of my relatives has lost in this way no less than five splendid horses within a short space of time, and millers' horses are very liable to the disease both here and on the Continent.

The calculi are formed in the large intestine (cæcum); they begin often by being triangular, or sometimes perfectly square, with rounded edges and corners, and become finally circular. In all cases they are formed of highly crystalline concentric layers, and attain to 18 or 20 inches in diameter, that is, as large as an ordinary gas-lamp globe. I believe that this is the greatest size they can arrive at, and that when so large as this, they already press out the sides of the intestine, producing inflammation and violent pain, which causes the animal to roll about in agony, and sooner or later kills him. I have met recently with two calculi of this enormous size, both cases being Staffordshire horses.

The usual remedy, as far as I have ascertained, has been, hitherto, some powerful purgative, chiefly aloes; and when the calculi are small or recently formed—not larger than walnuts—this appears to answer. But when large such treatment only increases the evil.

I find that the greater bulk of these calculi, large or small, consists of *phosphate of ammonia and magnesia*, and when a portion of the pulverised calculus is heated over a spirit-lamp on a platinum dish, it shows that very curious phenomenon of incandescence, or rather *phosphorescence*, peculiar to this salt at a certain temperature. The amount of organic matter is not great, but I have

found what I consider, at present, to be *lithofellic acid*, and a few other substances, but practically of no great importance.

The points to which I wish to-day to call the particular attention of veterinary surgeons and others are these—

1. That the calculi are owed almost entirely to phosphate of ammonia and magnesia.

2. That this salt is contained in the corn; and here arises the question whether *corn* is not for the horse as artificial a food as *meat* is for the human race.

3. The ease with which these calculi can be decomposed, broken up, dispersed, or dissolved by means of weak hydrochloric acid.

I am of opinion that repeated doses of very dilute hydrochloric acid, say 2 to 5 per cent, in water or spirit, if it can be made to reach them, would destroy the largest of these calculi in a comparatively short space of time. This treatment, with appropriate diet, would, I feel convinced, prove effectual even in very bad cases.

The disease no doubt originates from the cæcum becoming alkaline instead of remaining slightly acid as it should be in a normal state of health; the calculus itself is alkaline, and contains minute quantities of carbonate of ammonia and tribasic phosphate of magnesia, as well as the phosphate of ammonia and magnesia which constitutes the greater part of it. It is a very rapid disease; when once started a few years will find it increased very considerably. To cite one instance that has come under my own observation, a fine cart-horse was born in Hereford, where it remained four years, and then went to Staffordshire, where it lived five years longer. It died of calculus at nine years of age, and the calculus was 20 inches in circumference—the size of an ordinary gas-lamp globe—and weighed 8 lbs., so that it must have increased at least about 1 lb. a year, perhaps much more.

The lime in the water drunk by horses, to which some have attributed the disease, has nothing to do with it. It originates in the food—in the corn—as I have stated above, and is due no doubt, *in great measure, to a want of salt in the food*. When horses are highly fed for labour in the industrial districts, it is essential that they should have access to lumps of salt to lick, or have salt in their food and a liberal supply of water to drink. The ventilation and drainage of the stable is another important consideration. How many valuable beasts after a hard day's work pass the night in an atmosphere loaded with fumes of ammonia!—I am, &c.,

T. L. PHIPSON, Ph.D., F.C.S., &c.

Laboratory of Analytical Chemistry,
Putney, London, S.W.,
September 24, 1876.

DETERMINATION OF GOLD IN PYRITES.

To the Editor of the Chemical News.

SIR,—Why do M. H. Schwarz and the gentleman signing himself "Latent" in the CHEMICAL NEWS, vol. xxxiv., p. 132, propose to fuse the pyrites with iron turnings at all? There is nothing whatever to be gained by so doing, and they would get the gold into a quantity of regulus very much larger than necessary and very inconvenient for further treatment. If they simply fuse the pyrites alone at a strong heat, with such flux as the gangue, if any is present, may require, a very much smaller regulus will result, equally sure to contain all the gold, and equally suitable for treatment with acid.

The simplest mode of treating the insoluble residue after acting upon the regulus with acid, would be to collect it on a small filter, dry it, lay it upon a scorifier, cover with assay-lead, fuse, and scorify in a muffle, finally cupelling the lead-button. This method of assay might be advisable in cases where *very small* amounts of gold are to be determined; but in most cases it could not compare, for convenience, with the direct treatment of the ore by scorification or by reduction of litharge, concentration of two or three lead-buttons so obtained, and cupellation. —I am, &c.,

ASSAYER.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances, de l'Academie des Sciences. No. 10, September 4, 1876:

Researches on the Disappearance of the Ammonia Contained in Waters.—M. A. Houzeau.—Spring- and river water contains little ammonia, whilst rain, dew, and fog often contains it in abundance. Well-waters rapidly lose their ammonia, even when contained in vessels hermetically sealed. This loss is promoted by light.

Results Obtained on the Extraction of the Juice of the Sugar-Cane by means of New Apparatus.—MM. Mignon and Rouart.—The cane is cut up by means of a machine like that contrived by MM. Labrouse for reducing straw to a pulp for the paper manufacture. The pulp thus obtained is subjected to hydraulic pressure at 80 atmospheres. The canes thus yield 77 per cent of rich juice.

Detection of Magenta used in the Sophistication of Wines.—M. V. Didelot.—The author has forwarded to the Academy a sample of gun-cotton dyed with a wine containing magenta.

Dissociation of Bicarbonate of Soda at 100°.—M. V. Urbain.—The author maintains, in opposition to M. Gautier, that if dried plasma is submitted to a temperature of 100° the bicarbonate of soda which it contains is not decomposed.

No. 11, September 11, 1876.

Process for the Detection of Wines Artificially Coloured.—M. L. Lamattina.—To detect wines artificially coloured, the simplest method is to mix 100 grms. of the wine with 15 grms. of wine in coarse powder, stir the mixture for twelve to fifteen minutes, and filter through a double filter. If the wine is pure it passes through colourless, but if it preserves its colour it has been artificially coloured. If pure peroxide of manganese has been employed this process is applicable to all the colouring matters artificially introduced, including magenta. If the peroxide of manganese is ferruginous, the acids and salts of the wine dissolve the iron; magenta, if present, forms an insoluble compound, which remains on the filter. The filtrate then takes a faintly yellowish colour, resembling that of sesqui-salts of iron. In this case the peroxide of manganese left upon the filter is treated with alcohol, which dissolves the magenta, whilst the natural colouring matter of the wine is insoluble. If the alcoholic filtrate remains of a blue slightly yellowish the presence of magenta may be suspected. If we add to this liquid concentrated acetic acid, and then a few drops of ammonia, the colour of the magenta reappears after stirring for a few moments.

Note on the Radiometer.—W. Crookes.—(Extract from a letter to The Count Th. du Moncel.)

Justus Liebig's Annalen der Chemie, Band 182, Heft 1 and 2.

Contributions to the Theory of Luminous Flames.—Dr. Karl Heumann.—(Second section; see band 181, page 129.) The author considers the circumstances that a gas-flame does not actually touch the edge of the burner,

nor a candle-flame the summit of the wick; and that a flame never comes in close contact with a cold body is due to the fact that heat is conducted away by the solid body. The flame-gases are cooled for a certain distance below their ignition-point, and the flame is consequently extinguished within this region. The distance between a gas-flame and the burner is considerably increased if the inflammable gas or vapour streams out under a high pressure, or is mixed with a large amount of some non-inflammable gas. This phenomenon is due not merely to the cooling action of the gaseous stream and of the external air, but to the fact that the speed of the issuing gas stream close to the burner is greater than the speed of the propagation of ignition. When other influences are not essential, the flame begins in that section of the issuing gas-current where its speed equals the speed of the propagation of ignition. Hence this speed of propagation for different gases and vapours may be experimentally ascertained. In case of solids and liquids of a combustible nature the same speed may also be readily found by experiment, and the results may be regarded as relative numerical expressions of the dangerous character of the combustibles in question.

Communications from the Laborarory of the Polytechnic School of Delft.—These communications consist of a paper on "α-Xylenolol prepared from Metaxylol, by S. Lako, and a long and important dissertation by A. C. Oudemanns on the "Specific Rotatory Power of the more important Cinchona Alkaloids."

Composition of the Dialurates.—M. Menschutkin.—An account of the dialurates of ammonium, potassium, sodium, and barium.

On Tartronaminic Acid.—M. Menschutkin.—A product obtained on the decomposition of dialurate of sodium by means of water. Its composition is $C_3H_5NO_4$.

On Ethyl- and Methyl-Succinimid.—M. Menschutkin.—A brief account of the preparation, composition, and properties of these two bodies.

Substitution in Benzol.—F. Beilstein and A. Kurbatow.—Not suitable for abstraction.

Solid Compounds of Carbon in Meteorites.—J. Lawrence Smith.—To regard the carbonaceous matter of black meteorites as a kind of humus is contrary to all that we know of humus. The meteoric body is almost insoluble in alkaline lyes, gives off water only at a very high temperature after being previously dried at 110°, and burns readily upon platinum foil almost without odour, leaving much ash. According to the author's experiments it is neither humus nor true coal, but is probably an analogue of the so-called hydrate of carbon.

Examination of the Rotatory Power of the more important Cinchonic Alkaloids.—O. Hesse.—A valuable paper, but quite incapable of useful abstraction.

Behaviour of Phenol with the Cinchonic Alkaloids.—O. Hesse.—Cinchonidin and quinine combine readily with phenol, but the dextro-gyratory crystalline alkaloids, conchinin, cinchonin, and chinamin, are, in their free state, not capable of forming a phenol compound.

Remarks on Cynanchol.—O. Hesse.—The properties of this body as described by Butleroff agree with those of a mixture of echicerin and echitin.

Pyrophosphate of Lithia, Lithia-Soda, aud Lithia-Potassa.—M. Nahnsen and E. Cuno.—Not suited for abstraction.

Derivatives of Glycerin.—K. Kraut.—Among the derivatives described are iodtriethylglycinammoniumethylester glycin, chlortriethylglycinammoniumplatin chloride, and diethylglycinethylester.

Communications from the University Laboratory of Graz.—These consist of a paper on trichloro-butyric acid, by K. Garzarolli-Thurnlak; another by the same author on certain salts of glyceric acid; and one on the action of hydrochloric acid upon potassium chlorate by G. Schacherl.

On Phosphorus Pentafluoride.—T. E. Thorpe.—This compound, PF_5, is a colourless gas of a very pungent odour, and strongly attacks the throat and the mucous membranes. It fumes in the air, and is decomposed by water into phosphoric and hydrofluoric acids. It is four and a half times heavier than air, and can be poured from one vessel to another like carbonic acid. It is neither combustible nor a supporter of combustion. It is not modified by the passage of electric sparks, nor by the introduction of oxygen or hydrogen.

Oxidation-Product of Glycogen with Bromine, Silver-Oxide, and Water.—R. H. Chittenden.—The product is an acid, for which the author proposes the name glycogenic. He describes a number of its salts.

Amidous Derivatives of Hydroxylamin.—This embraces a notice of the metallic derivatives of hydroxylurea, and the double salts of other hydroxamic acids, by N. D. C. Hodges; and one on the ester of hydroxamic acids, ethyl-hydroxylamin, and methyl-hydroxylamin, by W. Lossen and Dr. J. Zanni.

Chemical Investigation of a Case of Cystinury.—Dr. W. F. Læbisch.—In this case the occurrence of cystin was accompanied by the usual marked decrease of urea and uric acid.

Reimann's Farber Zeitung.
No. 36, 1876.

Dr. Reimann, in a paper read before the Berlin Dyers' Association, described "Pittakall," the method of preparing which has been recently re-discovered by Grätzel, of Hanover. Pittakall is insoluble in water, but dissolves in alcohol and in acids with an orange colour, and in alkalies with a magnificent violet. It dyes wool and silk direct, but cotton only when previously mordanted. This colouring-matter is of an acid character, and yields—with salts of lead, barium, aluminium, and tin—violet precipitates. Patterns of silk, wool, cotton, and mixed goods, dyed with the new colour, were exhibited. These shades resist air and light perfectly and soap moderately.

A correspondent points out that red wines cannot be coloured with magenta, because the tannin present would precipitate it as a tannate.

Les Mondes, Revue Hebdomadaire des Sciences,
No. 1, September 7, 1876.

Three Years of Experience in the Evaporation of Mother-Liquors; Treatise on the Production of Salt, showing the Advantages of Combined Evaporation from the Bottom and the Surface.—Otto Pohl.—The author, a Liverpool salt merchant, describes in this paper a series of very carefully conducted experiments on the preparation of salt, and appears to have effected very decided improvements.

No. 2, September 14, 1876.

At the recent meeting of the French Association for the Advancement of Science, held at Clermont-Ferrand, the inaugural discourse was delivered by M. Dumas. The following passage is significant:—"Except the soul, its origin, and its destiny, which pertain to the sphere of faith, the rest of the universe belongs to science. Let us leave the soul to God, morals to religion and to philosophy (metaphysics), and human passions to the poets, and let us march on resolutely to the scientific conquest of the universe; the field is vast enough for our free discussions."

Hoffmann's "Fringe" Polarimeter.—The construction of this instrument cannot be made intelligible without the accompanying illustration.

A meteorological observatory has been established on the summit of the Puy de Dôme.

No. 3, September 21, 1876.

Fuming Sulphuric Acid.—M. Winckler proposes to manufacture this acid by passing a proper mixture of sulphurous acid and oxygen over platinised asbestos.

Gazzetta Chimica Italiana.
Anno vi., 1876, Fasc. v. and vi.

Use of Hydrosulphite of Soda as a Reagent in the Analysis of Colours fixed upon Tissues.—G. Scurati-Manzoni.—The facility with which orchil is discoloured by the action of hydrosulphite suggested the idea of using it for estimating the value of orchil-paste and extract, but the attempt proved unsuccessful.

Methods of Preparing the Iodides of Potassium and Sodium and the Bromide of Potassium.—P. Chiappe and O. Malesci.—To a solution of potassa at 30° B. the authors add iodine in fine powder till the mass remains coloured slightly red by iodine in excess. It is then mixed with iron filings, and heated in the sand-bath.

Observation on a Process for obtaining Iodic Acid by causing Chlorine to Act upon Iodine Suspended in Water.—G. Sodini.—In order that all the iodine should be converted into iodic acid, 1 part should be used in 20 parts of water.

Magistery of Sulphur.—M. Sansoni and G. Capellini.—The authors think it unnecessary to use pure hydrochloric acid, and employ the commercial quality, but free from arsenic.

Method of Detecting the Adulteration of Iodide of Lead.—L. Alessandri and C. Conti.—The usual adulterations are the chromate and carbonate of lead and the sulphate of baryta. Among the available tests they give the preference to potassa and ammonia, with which the detection of chrome is easy.

A New Reagent for the Detection and Determination of Glucose.—A. Soldiani.—416 grms. of bicarbonate of potassa; 15 grms. of basic carbonate of copper, dry; 1400 grms. of distilled water are placed to heat on the sand-bath in a porcelain capsule for about six hours, the liquid being kept always at the same level by adding water to make up for what is lost by evaporation, and stirring. The heat is withdrawn when the evolution of carbonic acid ceases; it is left to settle, and filtered, and concentrated to 800 c.c.

Preparation of Ferric and Cupric Oxides from their respective Sulphates without the Production of Basic Sulphates.—A. Oglialoro.—The author recommends to pour the sulphate of iron into a solution of an alkaline carbonate.

Moniteur Scientifique, du Dr. Quesneville,
September, 1876.

Relations of Chemistry with Physiology and Pathology considered especially with regard to the Brain.—C. T. Kingzett.

Chemistry of Diabetes Mellitus.—C. T. Kingzett.
These two papers are translated from the English.

Pepper and its Principal Adulterations.—E. Laudrin.—Amongst the ordinary sophistications of pepper, the author enumerates pepper-dust, the epidermic portion detached from the pepper; mineral matters, such as plaster, chalk, clay, ochre, &c.; grains of paradise; dregs from the manufacture of potato-starch; farina of leguminaceous seeds; olive kernels freed from oil and ground (these are regularly sold to the trade in France as "olive crusts—*grignons*—for pepper"); laurel leaves and oil-cakes.

Assay of Commercial Oils.—A. Pinchon.—The author recommends, for ascertaining the purity of commercial samples of oils, a hydrometer inclosing a thermometer. A precisely similar instrument has been in use in Germany and in England for about twenty-five years, under the name of Fischer's oleometer.

Anti-fermentescible Action of Salicylic Acid.—M. Neubauer.—An examination of the power of salicylic acid to arrest fermentation.

Chemical Indications relating to the Applications of Salicylic Acid.—H. Kolbe.

Use of Salicylic Acid to prevent the Fermentation of Syrups.—H. Lajoux.

The nature of these two papers is sufficiently evident from their title.

NOTES AND QUERIES.

*** Our Notes and Queries column was opened for the purpose of giving and obtaining information likely to be of use to our readers generally. We cannot undertake to let this column be the means of transmitting merely private information, or such trade notices as should legitimately come in the advertising columns.

Organic and Mineral Phosphates in Manure.—Will any of your readers inform me of a method of distinguishing accurately between organic and mineral phosphates in a mixed manure.—E. C. Potter.

Elementary Physics and Geology.—Will any of your readers kindly give me the name of a good German book on elementary physics and on elementary geology.—W. T. Philipson.

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Early in October.

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KING'S COLLEGE.—EVENING CLASSES.

WINTER SESSION, 1876-77.

The Evening Lectures commence on Monday, October 9th, and terminate in March.

CHEMISTRY—Mr. W. N. Hartley, at 7 o'clock. Mondays and Thursdays. Fee, £1 11s. 6d.

ANALYTICAL CHEMISTRY—Tuesday from 7 to 9. Fee, £2 2s.

SALICYLIC ACID.

NOTICE IS HEREBY GIVEN that Messrs. Burgoyne, Burbidges, Cyriax, and Farries, of 16 Coleman Street, London, E.C., are the Sole Consignees of Salicylic Acid manufactured by Dr. F. Von Heyden, Chemical Manufacturer, Dresden, under Letters Patent, No. 595, 1874. Legal proceedings will be taken against all persons manufacturing, importing, or sending Salicylic Acid produced according to the said Patent without the License of the Patentee.—Dated the 18th day of September, 1876.

J. Henry Johnson, 47, Lincoln's Inn Fields, W.C.,
Solicitor for the Patentee, Professor Hermann Kolbe.

THE CHEMICAL NEWS.

Vol. XXXIV. No. 881.

DYSODILE.

By Prof. A. H. CHURCH.

The paper-coal from Melili, Sicily, has been long known. Similar minerals have been described from several lignite deposits in different parts of Europe. I have often desired to ascertain whether there might be any near relationship between this paper-coal (sometimes termed *dysodile*) and the *tasmanite*,* which I analysed and described in 1864 (*Phil. Mag.*, IV., xxviii., 465). Both minerals burn with a most offensive odour, fully accounted for in the case of tasmanite by the presence of much unoxidised sulphur in union with the carbon, hydrogen, and oxygen of the mineral. Analysis shows, however, that the resemblance of the two species is very slight, as the following results will demonstrate.

A characteristic specimen of dysodile from Rotl, near Bonn, was submitted to examination. To remove matters soluble in water, and notably gypsum, it was powdered, and then washed with much water. Subsequently it was treated with moderately strong hydrochloric acid, until neither iron nor sulphuric acid could be detected in the acid liquid or washings. Thus it was expected that the high percentage of mineral matter in the original sample would be lowered, while all sulphates would at the same time be removed. The latter change was probably accomplished, not so the former. The following figures comprise the chief analytical data from which the ultimate composition of dysodile may be deduced :—

A. *Dysodile thoroughly washed with Water and Hydrochloric Acid, and dried at* 100° *C.*

0·328 grm. gave 0·1640 grm. *ash*, or 50·00 p.c. ash.
0·328 ,, ,, 0·0980 ,, Fe_2O_3, or 28·88 ,, ZnO_3.
0·651 ,, ,, 0·0555 ,, $BaSO_4$, or 1·17 ,, S.
0·593 ,, ,, 0·7315 ,, CO_2, or 34·56 ,, C.
0·593 ,, ,, 0·2685 ,, H_2O, or 5·03 ,, H.

B. *Dysodile treated with Water and stronger Hydrochloric Acid.*

0·0885 grm. gave 0·0298 grm. *ash*, or 33·67 p.c. ash.
0·3415 ,, ,, 0·0615 ,, $PtAm_2Cl_6$ or 1·13 ,, N.

It appears from the above figures that the composition of the carbonaceous or combustible part of dysodile may be represented by the following percentages, if the ash present be previously deducted :—

Composition of Dysodile.

	In 100 parts.
Carbon	69·01
Hydrogen	10·04
Sulphur	2·35
Nitrogen	1·70
Oxygen	16·90

It is thus evident that dysodile does not belong to the same group of minerals as tasmanite, for the latter species is 10 per cent richer in carbon than the former. Dysodile, indeed, is possibly, perhaps even probably, a mixture of two or more distinct substances. Nor can the percentages given above be regarded as necessarily representing the carbonaceous constituent of the mineral. The sulphur, for example, may really belong to some fixed sulphide, such as pyrites, in the ash. Not till dysodile can be secured tolerably free from ferruginous ash can the mode of combination in which the sulphur occurs be determined. As tasmanite can be obtained (by the use of mechanical means, aided by the action of hydrochloric and hydrofluoric acids) contaminated with no more than 1¼ per cent of a white or grey ash, we can prove that the high percentage of sulphur in that species exists in organic union with carbon, hydrogen, and oxygen, and not in the form of iron pyrites.

* See Dana's "Mineralogy," 5th edition, pp. 746 and 747.

NOTE ON THE EFFECT OF TEMPERATURE ON THE GROWTH OF POTATOES.

By J. B. HANNAY, F.R.S.E.

In a former paper published in this journal* I gave my reasons for rejecting the theory that the proportions of the inorganic constituents have much to do with the health of the plant; in short, that we could not by an analysis of potato ash declare whether the tuber had been sound or not. I there showed that sound or diseased potatoes from the same field had virtually the same proportions of inorganic compounds, while potatoes from the same seed grown on different soil may have very different proportions of these compounds. These results have since been corroborated by other investigators, but I would wish to place on record further evidence I have obtained by analysis of the ash of potatoes grown near the sea-shore as compared with that of tubers from the same seed grown at some distance from it; both soils were gravelly. In the subjoined analyses No. I. is that from the shore, and No. II. that from inland. They both received the same manure. The method of analysis was that used by Bunsen.

	No. I.	No. II.
Percentage of ash from dried tuber	4·25	4·08
Soluble portion—		
Potassium	32·55	38·81
Sodium	10·87	3·96
Magnesium	2·22	1·04
Carbon dioxide	14·29	14·97
Phosphoric oxide	4·01	5·83
Sulphuric oxide	2·74	5·22
Chlorine	10·59	6·58
Insoluble portion—		
Silica	1·85	1·94
Ferric oxide and alumina	0·25	0·80
Calcium	3·69	4·17
Magnesium	1·15	0·73
Carbon dioxide	1·31	1·88
Phosphoric oxide	3·40	4·17
Unburnt carbon	0·50	0·62
Oxygen equivalent to metals minus equivalent proportion of chlorine	11·63	10·68
	100·45	101·40

Both these samples of potatoes were pretty good, the last portions of the carbon were very difficult to burn away, and the starch granules were large, and on being boiled the skin of the potato burst owing to the swelling of the starch granules which the tuber contained, and yet we see that as in the case of some other plants a large proportion of one element may be replaced by another without injuring the root. It will be noticed that in diseased or weakly tubers the potassium and sodium are nearly always present in greater quantity than in those of a healthy nature. I do not think that that is so much owing to an actual excess of these elements in the diseased tubers as to the fact before mentioned that it is

* "On the Inorganic Constituents of Sound and Diseased Potatoes," Chemical News, vol. xxvii., p. 147.

more difficult to completely oxidise the carbon in healthy tubers than in the diseased ones, and that a portion of these volatile substances is lost during the protracted ignition. This fact that the inorganic constituents are less intimately combined with the carbon compounds in diseased tubers than in those which are healthy led me to the conjecture that a kind of constitutional decay was the precursor of the real disease. The paper above referred to concluded as follows:—"On the whole I think the potato disease is a problem for the naturalist or the physiologist rather than the chemist." Now the researches of Mr. Worthington Smith have proved that the conjecture was correct, but the fact still remains unexplained that even during the worst periods of disease some fields escape infection. And I found on careful inquiry that as a general rule those fields which escaped were of a darker colour than those attacked, and this led me to the conjecture that the heat caused by the absorption of the solar rays must strengthen the constitution of the plant. Besides, as I pointed out in my former paper, soot is considered by practical men as a preventive of the disease, and it occurred to me to determine by experiment whether, besides the good which its contained ammoniacal salts does, a part of its virtue may not lie in its imparting a dark colour to the soil and so rendering it a better absorbent of solar heat. I therefore had the following experiment tried to decide this question:—

A piece of ground was chosen, little adapted for the growth of potatoes, consisting of a kind of blue till. The ground was divided into two parts, and both were planted with potatoes in the ordinary way, using stable manure. The one half was left as planted, while the other was covered with soot which had been carefully washed till no soluble matter remained in it. Those with the soot sprouted first and were all through much healthier than the others. A series of temperatures were taken until the foliage was too thick for much sunlight to penetrate, and then resumed when the foliage was beginning to fail till the tubers were dug up. The temperature of the air was not kept, as we have no idea from it what is the real temperature of the leaf, as we do not know how much heat it absorbs from the sun's rays. All the temperatures were taken on sunny days as on otherwise there was no difference in temperature. The following table gives the two series of temperatures. They were taken at 2 and 8 inches below the surface and always simultaneously, but not at regular intervals, and in reality do not represent the actual average temperature of the earth, but they serve the purpose I intended to show—the higher temperature of the dark coloured earth.

	Earth Covered with Soot.		Pure Earth.	
	Depth 2 ins.	Depth 8 ins.	Depth 2 ins.	Depth 8 ins.
	55·4	52·6	53·0	52·1
	56·9	55·0	55·2	55·4
	67·2	63·9	65·1	60·8
	64·5	63·2	63·8	62·4
	61·7	58·7	58·8	58·0
	63·0	60·6	61·4	59·2
	58·1	56·9	57·2	56·3
	64·2	62·2	63·5	61·8
	65·4	63·8	63·9	62·0
	63·2	61·4	60·0	60·0
Average	61·96	59·83	60·19	58·74

These numbers show distinctly that the potatoes grown in a dark soil have a warmer climate, so to speak, than those in a light one. The tubers with no soot were weak and a great deal of disease among them, whereas those which had the covering were larger and nearly all healthy. Still, as the following numbers show, the principal inorganic constituents were present in nearly the same proportions. No. I. is from the soot-covered tubers, No. II. from the others.

	No. I.	No. II.
Percentage of ash	3·85	4·27
Potassium	38·25	39·73
Sodium	2·17	2·04
Magnesium	2·42	2·87
Calcium	4·02	3·75
Phosphoric oxide	10·94	10·51
Sulphuric oxide	5·22	6·83
Chlorine	5·08	6·15

The principal result to which I wish to draw attention, however, is the manner in which the starch granules are developed in the two sets of tubers. First as to quantity. The method of estimating the starch was as follows:—The best potatoes from both portions of the soil were cut up and dried, and a weighed portion treated with alcoholic potash to remove sugar, fat, &c., and dried and weighed; then treated with diluted hydrochloric acid to remove the starch, and again dried and weighed. The difference between the last two weighings gives the starch in the original quantity. In this way the potatoes grown under soot gave 22·5 per cent of starch and those in the plain ground 17·5 per cent, a difference of 5 per cent. Then as to the size of the starch granules:—Micrometrical measurements of 20 average granules in the good potatoes gave an average of 0·175 m.m., whereas 20 of those from the diseased tubers gave only 0·155 m.m. We see from this that not only were the granules smaller but their number was less. In the potatoes poor in starch the substance was altogether of a more fibrous nature. It thus appears that the increase in temperature gives a great impetus to the growth of starch granules both in size and number. I know that an investigation like this would require to be extended over several years to make sure of a definite law, and such was my intention, but as I had to leave this country last spring the experiments I intended to carrry on this year were not accomplished, and I have no prospect of being able to resume the investigation soon; so I considered in these circumstances that the above results were sufficiently striking to warrant publication.

BLOWPIPE ANALYSIS OF THE NEW MINERAL HENWOODITE.

By MAJOR ROSS, late R.A.

THE first number of the *Mineralogical Society's Journal* contains the blowpipe analysis by Berzelian methods of this interesting mineral, written by Dr. C. Le Neve Foster, H. M. Inspector of Mines, who seems also to have discovered it; and Mr. J. H. Collins, the Society's Secretary, having been so kind as to forward me by letter a few pin's-head fragments of the mineral for the purpose of testing them by my methods, I have the pleasure now to send you an account of these, but, in the first place, append Dr. Foster's analysis.

"*Colour.*—Turquoise blue.
"*Streak.*—White, with bluish green tinge.
"*Matrass.*—Turns brown, gives H_2O, slight decrepitation.
"Pt *forceps.*—Colours flame green, does not fuse.
"C *alone.*—Does not fuse.
"*Borax.*—O.F. green hot, blue cold.
"*Borax.*—R.F. on C; Cu reduced.
"Carb. soda on C; obtained metallic Cu.
"*Berzelius's test for* P_2O_5.—Boric acid and Fe on C obtained round globule of phosphide of iron.
"*Dissolved in* H_2SO_4, added ammonia, blue solution, and white flocculent precipitate (Al_2O_3).
"Filtered, added oxalate of potassium; decided turbidity (CaO).

"The mineral is therefore a hydrated phosphate of alumina and copper with a little lime."

Dr. Foster states, with reference to the discovery:—"In looking over some specimens of *chalcosiderite* [a mineral not given by Bristow, and which the writer of this article therefore supposes to be also a new species, containing copper and iron] I noticed a bluish green mineral which was different from the rest, and subsequently, on calling the attention of Capt. Hosking, of West Phœnix, to the mineral, I obtained several pieces from him." It certainly shows great sagacity on the part of Dr. Foster to have suspected the presence of phosphoric acid in this mineral, unless *chalcosiderite* also contains that acid, but it is unfortunate that he should have omitted his reasons for the surmise from his analysis. It will be observed that, for the detection of alumina and lime, the "wet way" has to be resorted to, while the iron present is not detected at all.

*Henwoodite.**

(1.) *Appearance.*—A rounded aggregation of lenticular crystals; pale green-blue.

(2.) *On* Al *plate in* O.P.—Colour changed to chocolate-brown.

(*a.*) Adhered to a magnet (apparently due to particles of *Goethite*, which were carefully removed from the crystals).

(*b.*) Green pyrochrome; might be due to copper, molybdenum, barium, phosphoric acid, &c.; no sublimate, no sulphur reaction.

(3.) *Crushed* (2) *between agates, and treated some minute particles on a bead of boric acid in* O.P.—Blue-green pyrochrome† = copper.

(*a.*) Streaks of curdy matter, heating into opalescence = phosphoric acid or water; see (5).

(*b.*) White amorphous fragments; black do., with rusty matter round. White balls = calcium phosphate, one grey ball, one black ball, all opaque. The whole bead was interspersed with shining crystalline spots = insoluble SiO_2?

(4.) *Added a fragment of pure lime under* O.P.—A large clear ball; pale yellow-green hot, nearly colourless cold = FeO. (A particle of cupric oxide *without iron* colours a similar ball brilliant *chrome green*, hot or cold.)

(5.) *Clarified the opalescent bead with potassium carbonate and magnesium sulphate.*‡

(*a.*) *Added fresh boric acid under* O.P.—The clear bead became opalescent on cooling = presence of phosphoric acid.

(6.) *Heated another piece of* (1) *with pure oxide of lead on a charcoal mortar on aluminum plate.*—Fused with great effervescence to a crystalline mass of plumbic phosphate, with minute balls of copper interspersed.

(This new test for cupric phosphate is best seen with *Libethenite*. The copper disengaged seems beautifully pure.)

(7.) *Heated a fresh piece of* (1) *with sodium carbonate on* Al *plate in* O.P.—Fused to a brick-red mass = Cu_2O.

(8.) *Crushed* (7) *in* (*a*) *forceps*§ *on agate slab, and boiled in water acidulated with boric acid.*—Two precipitates (*a*) brown, flocculent, above; and (*b*) brick-red, below = Cu_2O.

(9.) *Treated* (8 *a*) *in a boric acid bead under* O.P.—Great opalescence = phosphoric acid (as was seen by (5 *a*); some opaque white balls; ditto ditto fragments; two black balls; several clear small crystals = SiO_2.

(10.) Repeated (5) and again proved the presence of phosphoric acid.

Remarks.—The presence of alumina or aluminum phosphate is seen from (3 *b*) and (8 *a*); of silica from (3 *b*) and (9); of lime from the white *balls*, which might, however, have been MgO. The presence of copper was so evident that it was unnecessary to use phosphoric acid as a detective.

The minuteness of these details (necessary where a process is described for the first time) makes the analysis appear much longer than it is, but the essential character of the mineral appears in operation (3), what follows that is chiefly confirmative.

September 19, 1876.

* I had the great advantage of seeing Mr. Collins's quantitative analysis of the mineral in the Society's journal, but having lent my copy to a pupil (Mr. Lombard), I only remembered that Henwoodite is "a hydrated phosphate of alumina and copper."

† Abnormally coloured flames are called "pyrochromes" by me

‡ See page 186, "Pyrology," "The Test for Phosphoric Acid."

§ See page 63, *Ibid*, Article, "*Material*."

NOTE ON THE RADIOMETER.*

By WILLIAM CROOKES, F.R.S., &c.

DURING the last three months several papers have been read before the French Academy respecting the radiometer. On reading these papers I find that the various experiments performed are in general repetitions of some which I have devised during the four years I have been working at the subject. The descriptions of my experiments and the results I have obtained have been communicated by me from time to time to the Royal Society. Unfortunately, however, these papers do not appear in the *Philosophical Transactions* until twelve or eighteen months after they have been read, and according to custom I could not communicate them to other learned Societies. If these *savants* had seen my papers they would have found that I had not only tried the experiments, but that I had also discussed the evidence both for and against the several theories they have advanced to account for the action of the radiometer. The experiments with radiometers are almost all described in the third and fourth parts of my paper: these were read before the Society on February 10th, 1876, while in parts one and two I have considered the various supposed causes of the phenomena.

In the *Comptes Rendus* for July 3rd, 1876, M. Govi describes an experiment showing the action of dark heat on the instrument. This experiment is described in the paper read before the Royal Society on February 10th, and was also shown at a *Soirée* of the Royal Society on April 5th. The radiometers described by MM. Alvergniat and Gaiffe, in the *Comptes Rendus* of July 24, differ in nothing from those that I had previously caused to be constructed, and which are also described in the paper referred to above, while M. Ducretet's experiment of pouring ether upon the case of the radiometer was demonstrated to my audience on the occasion of my lecture at the Royal Institution, on February 11th, 1876. At the Royal Society *Soirée*, April 5th, I exhibited the turbine-radiometer, and this is also described in the paper read on February 10th. In the *Comptes Rendus* for June 19th a similar instrument is explained by M. de Fonvielle. With regard to the cause of the rotation, M. de Fonvielle adheres to the theory of emission; while M. Fizeau, in the *Comptes Rendus* of May 29th, attributes the action to, first, a slight excess of temperature acquired by the discs as compared with the ambient medium under the influence of light; secondly, to the unequal powers of emission and absorption of two opposite surfaces (black and polished of each disc; thirdly, to the presence, in the apparatus, of a small quantity of elastic fluid. In the No. for June 19th M. Govi refers to Fresnel's experiments, which he will find described in my paper read in December, 1873; and he also says that, if the thermic currents of rarefied gases contained in the receiver do not suffice for explanation of the facts observed, there is another explanation, namely,

* Translated from a Letter to Count du Moncel, published in the *Comptes Rendus*, September 11, 1876.

by the dilatation by heat or the contraction by cold, of the gaseous layers which all bodies retain on their surface, even when placed in an absolute vacuum. In the *Comptes Rendus*, June 26, M. Ledieu bases his explanation on a mechanical action of the "ether" perpendicularly to the direction of its rays of propagation, and not in the same direction as those rays. Others ascribe the action to electricity. Now, in my paper read before the Royal Society in April, 1875, I have discussed all these theories, and described the experiments consequent upon them. I have there shown that, while either of the theories will account for some of the phenomena, it is not so easy to find an explanation which will satisfy all the conditions of the problem. Referring to M. Hirn's communication in the *Comptes Rendus* of June 26, I may mention that on March 30, 1876, I read a paper at the Royal Society on the "Movement of the Glass Case of a Radiometer," in which I showed that the internal friction, either of the steel point in the glass socket, of the vanes against the residual air, or of both these causes combined, was considerable; and on the 15th of June last I stated, in a paper to the Royal Society, that the evidence afforded by my latest experiments is to my mind so strong as almost to amount to conviction that the repulsion resulting from radiation is due to an action of thermometric heat exchanged between the surface of the moving body and the case of the instrument through the intervention of the residual gas. This explanation of its action is in accordance with recent speculations as to the ultimate constitution of matter and the dynamical theory of gases.

MEMOIR ON THE ACTION OF ALCOHOL ON THE BRAIN.*

By CHARLES T. KINGZETT, F.C.S.,
London and Berlin.

THE question of the action of alcohol on the nervous system has long occupied the attention of physiologists, but the researches that have been conducted at various times by various workers have not led to any very decided results. They have, moreover, been directed to a study of the *channels* through which the alcohol may be supposed to act, rather than to the action itself. This, indeed, was almost unavoidable, for although there were many theories regarding the *modus operandi* of alcohol in the system, and especially in regard to the nervous system, our knowledge of the nervous system itself was very imperfect, and remained so until quite recently, when, by the researches of Thudichum, the chemical constitution of the brain has been elucidated. (More recently, papers on the specific points of the same subject have been published by Thudichum and the author.) The possession of this knowledge enables us to indicate fresh lines of research from which the physiological action of alcohol may be studied.

In 1859 Dr. Marcet, F.R.S., read before the British Association a paper on this subject, in which he endorsed the views of Dr. J. Percy, who had, in 1839, published a research on the presence of alcohol in the ventricles of the brain. Dr. Percy concluded "that a kind of affinity existed between the alcohol and the cerebral matter." His investigation was of an experimental nature, and he states that he was able to procure a much larger proportion of alcohol from the brain than from a greater quantity of blood than could possibly be present within the cranium of the animal upon which he operated.

Dr. Marcet in considering these researches alludes also to the researches of L. Lallemand, Michel Perrin, and Duroy, "who withdrew the blood from the brain in cases of poisoning with alcohol, and succeeded in extracting alcohol from the cerebral substance, thus free from blood." (*loc. cit.*) Finally, he describes physiological experiments, from which he concluded that "alcohol acts *principally*, though not *exclusively*, on the nervous centres by means of absorption, and consequently through the circulation;" and, further, that it also "exerts a *slight* but *decided* action on the nervous centres through the nerves, independently of the circulation."

The more general question of what becomes of alcohol in the system has been far more deeply studied. I do not propose to enter into it except so far as to indicate our present absolute knowledge on this point.

Thudichum was the first to determine quantitatively the amount of alcohol eliminated by the kidneys from a given quantity of alcohol administered, and the result was sufficient in itself to disprove the elimination theory, at that time prevailing very widely.

The subject, however, was followed up by Dupré and others, and the results of their continued researches may be given in Dupré's own words (See *Practitioner*, March, 1872), from the abstract of a communication to the Royal Society:—

"(1.) The amount of alcohol eliminated per day does not increase with the continuance of the alcoholic diet; therefore, all the alcohol consumed daily must, of necessity, be disposed of daily, and as it is certainly not eliminated within that time it must be destroyed in the system.

"(2.) The elimination of alcohol following the taking of a dose of alcohol is completed twenty-four hours after the last dose of alcohol has been taken.

"(3.) The amount eliminated in both breath and urine is a minute fraction only of the amount of alcohol taken."

Now it must be pointed out in regard to all these researches that they have reference to quantities of alcohol, which are certainly below those quantities which by consumption give rise to "delirium tremens." In this disease the amount of alcohol eliminated is much greater, and, in any case, the fact that alcohol is *not* eliminated does not prove what becomes of it. Certainly we know that it is oxidised in the circulation, but we neither know the products of that oxidation nor the time which is necessary for its completion, and if there be any truth in the researches of Percy and others alluded to, the alcohol may be absorbed into and remain with the cerebral matter or other tissues until, by the obtaining of necessary conditions, it may be re-absorbed into the circulation and oxidised there. Meanwhile, assuming it to remain for a time with the cerebral matter, how may it be supposed to act in order to bring about the disease called "delirium tremens?"

It had been my intention to determine quantitatively the amount (if any) of alcohol which may remain in the brain-substance of animals to which large quantities of alcohol may be administered. In this matter, however, I have been disappointed, and my researches therefore go upon the assumption that Percy was right in his conclusions.

I have pointed out in a previous publication, "On the Relations of Chemistry to Physiology and Pathology with special reference to the Brain." that alcohol may be supposed to act, when present in large quantity, upon brain-matter in one of two ways, or in both. (See CHEMICAL NEWS, vol. xxxiii., p. 79.) The brain, with its water of colloidation, has a mobility of ultimate particles, which enables it to assimilate matters from the blood which readily diffuses through it on the one hand, and a penetrability which allows of the crystallisable products of life being carried away by the blood on the other side. Now, from what Thudichum has found regarding the chemical constitution of the brain (See "Report of the Medical Officer of the Privy Council and Local Government Board," New Series, No. III.), it may be supposed that alcohol would act on it as a whole by robbing it of its mobile character, so essential to its healthy functions, and consequently impair its power to assimilate its food and its

* Read before the British Association, Glasgow Meeting (Section D.).

power to throw off the products of its life functions: or alcohol may be supposed to act by dissolving traces of the principles of which brain-matter is composed—albumin, kephalines, myelines, and cerebrines, &c.

I now proceed to describe the experiments I have conducted to study these points before stating the conclusions which follow from them.

As it was impossible to carry on my experiments either upon live beings or upon human brains, I had recourse to ox brains, which in each case were removed from the skull after death and immediately before experimenting upon them.

Experiment I.—In this experiment an ox brain, recently removed from the skull, was maintained by means of a water-bath, at a temperature of the blood, suspended in water containing varying amounts of alcohol, or in water alone for seven hours in each case.

The amounts of water and alcohol employed in the various experiments were as under:—

	Water.	Absolute Alcohol.	Alcohol equals—
A.	1000 grms. and	200 grms.	16 per cent.
B.	1000 ,,	100 ,,	9 ,,
C.	1000 ,,	200 ,,	16 ,,
D.	1000 ,,	100 ,,	9 ,,
E.	1000 ,,	50 ,,	5 ,,
F.	1000 ,,	0	—
G.	1000 ,,	200 ,,	16 ,,
H.	1000 ,,	400 ,,	27 ,,
I.	1000 ,,	400 ,,	27 ,,

The method of examination employed consisted in the evaporation of the various extracts to dryness in a water-bath and the analysis of the products.

The amount of matter which passed into solution gradually diminished with each extraction, while the nature of the matters dissolved appeared identical or nearly so, with the exception of the first extract. This contained more albumen, and what may be called water-extracts of the brain. These matters, to be presently described, would appear to have been present in great part diffused through the brain, *not* in a state of strong combination; they might, therefore, be regarded in part as food-forming matters, or as brain excrementitious educts.

As much as was necessary of the small amounts of matter dissolved in each case was used for ascertaining the specific nature of the constituents. Those quantities remaining over were united and examined in bulk.

Among the constituents were observed myeline, and identified by the test with sulphuric acid and sugar; by its deposition from an alcoholic solution on cooling; by its $CdCl_2$ salt; and the presence of phosphorus both in the free body and the $CdCl_2$ salt.—No kephaline dissolved. A considerable amount of water extractives, containing a phosphorised principle insoluble in strong alcohol, and not before recognised.—Potassium, chlorine, and alumina.

Before the conduction of trial F. the brain was allowed to stand in water during twelve hours to wash it free from any alcohol that may have been left in it from the previous experiments. The extract in this experiment certainly contained myeline, and also the phosphorised principle insoluble in strong alcohol, besides alumina. A form of cerebrine was also found amongst the dissolved matters, no matter whether alcohol had been used or not. It was established by re-crystallisation from alcohol, inability to form a $CdCl_2$ salt, and its freedom from phosphorus.

It should be observed that in the later extractions, although much alcohol was employed, the *amounts* of matter dissolved were extremely small. This gradual decline in the amount of matter extracted may be ascribed to two causes. First, apparently there existed diffused through the brain matters in a state of solution, left there doubtless by the blood; but, secondly, the brain gradually grew harder and firmer, until finally its mobility of particles was almost entirely lost. Such a growth in the hardness would prevent the intimate ingress of the solution into its parts.

It was chiefly to test this last statement that *Experiment* II. was conducted. This employed a fresh ox brain, which was hardened by boiling in water for ten hours (in two successive litres). After this it was extracted as described, and the weights of the extracted matter dry at 100° C., and its analysis was in each case registered. These are tabulated.

	Nature of Solution used to Extract.	Weight of Matter Dissolved.
A.	2 litres H_2O at 100° C.	4·6 grms.

Nature.—No kephaline; cerebrine; myeline; no phosphates; extract was precipitated by PbA; no H_2SO_4 much Cl; phosphorus; albumin.

	Nature of Solution used to Extract.	Weight of Matter Dissolved.
B.	200 grms. alcohol, 1000 ,, water =16 p.c. alcohol.	1·0 grm.
C.	1000 grms. water.	0·5 grm.
D.	400 grms. alcohol, 1000 ,, H_2O =27 p.c. alcohol.	0·4 grm.
E.	1000 grms. water.	0·3 grm.
F.	600 grms. alcohol. 1000 ,, water =35 p.c. alcohol.	0·6 grm.
G.	400 grms. alcohol, 1000 ,, water =27 p.c. alcohol.	0·25 grm.
H.	400 grms. alcohol, 1000 ,, water =27 p.c. alcohol.	0·40 grm.
I.	400 grms. alcohol, 1000 ,, water =27 p.c. alcohol.	0·28 grm.
J.	1000 water.	Lost.
K.	1000 water.	0·19 grm.
L.	1000 water.	0·19 grm.

Nature.—All these extracted matters seemed of similar nature, and all gave the purple reaction with H_2SO_4 and sugar. For analysis see Experiment III.

Experiment II. seemed to indicate (see F.) that when the amount of alcohol exceeded a given quantity more matter was dissolved, and in order to confirm this, and to ascertain its nature, the following—

Experiment III. was carried out on a new ox brain. Each extraction, like as in experiments I. and II., was sustained during seven hours at a blood-heat. The results are tabulated.

	Extractive Solution Employed.	Weight of Matter Dissolved. Grms.
A.	1000 grms. water	1·40*
B.	400 grms. A., 600 W., =37 p.c. alcohol	1·70
C.	400 ,, 600 ,, 37 ,,	0·84
D.	400 ,, 600 ,, 37 ,,	0·80
E.	400 ,, 600 ,, 37 ,,	0·60
F.	400 ,, 600 ,, 37 ,,	0·50
G.	400 ,, 600 ,, 37 ,,	0·40
H.	1000 grms. water	0·40
I.	1000 ,, ,, ...	0·35
J.	1000 ,, ,, ...	0·30
K.	1000 ,, ,, ...	0·28
L.	1000 ,, ,, ...	0·28
M.	400 grms. A., 600 W., =37 p.c. alcohol	0·25
N.	400 ,, 600 ,, 37 ..	0·23
O.	600 ,, 400 ,, 54 ..	0·85
P.	600 ,, 400 ,, 54 ..	0·90
Q.	500 ,, 500 ,, 46 ..	1·90†

* Not including albumin, which was removed by filtration from concentrated extract.

† In this experiment the brain before extraction was minced.

This experiment gives rise definitely to three conclusions. Allowing for that decrease in the amounts of matter dissolved, and caused by the hardening of the brain, it would appear—

(1.) That up to a certain amount dilute alcohol extracts no more matter than water.
(2.) If that quantity be exceeded (see O., P., Q.) much more matter dissolves.
(3.) That while the influence of hardening the brain is confirmed by Q., it would appear that in healthy life, when the brain is of a very mobile character, similar quantities of alcohol to those here used would dissolve a considerable amount of matter from the brain.

The matters extracted in Experiments II. and III., remaining over that used previously, were united and analysed together. On extraction with ether a red-coloured solution was produced, from which alcohol precipitated 0·7 grm. kephaline, ($C_{42}H_{79}NPO_{13}$), which was identified by its properties. The ether alcoholic mother-liquor contained 2·0 grms. more kephaline.

The matter insoluble in ether was extracted with boiling 85 per cent alcohol. From the alcoholic solution 0·6 grm. of mixed cerebrine and myeline, $C_{34}H_{68}N_2O_8$ and $C_{42}H_{83}NPO_9$, was deposited on cooling. The mother-liquor contained a further quantity of 4·0 grms.

The matter insoluble in alcohol was now exhausted with boiling water, and the extract on evaporation to dryness weighed 4 grms. It constituted ordinary water-extracts of brain.

The matter left insoluble by the water weighed 2·5 grms., and was chiefly albuminous in nature, making a total of 13·8 grms. matter.

Experiment IV. was designed to ascertain what influence (if any) was introduced by skinning the brain previous to extraction. This was done because the conditions obtaining in life are such as to allow more readily of the passage of alcohol-bearing liquid through the brain-matter than can be secured after death. The brain was skinned after extraction A. and before B. The results, while they sustain the conclusions previously given, are not indicative of any new feature.

Extractive Solution used.	Weight of Matter Dissolved.
	Grms.
A. 1000 grms. water	2·20
B. 1000 ,, ,, ...	4·10
C. 364 grms. A., 600 W., =37 p.c. alcohol	Lost
D. 400 ,, 600 ,, 39 ,,	1·60
E. 340 ,, 600 ,, 34 ,,	0·66
F. 1000 grms. water	—
G. 340 grms. A., 600 W., =34 p.c. alcohol	0·40
Total	8·96

The matter extracted in this experiment was submitted to analysis, and found to contain no kephaline, but gave 1·1 grms. of myeline (including any cerebrine present), and 1·25 grms. of albumin; the rest was constituted of potassium chloride and extractives, including a trace of lactic acid.

I now wished to demonstrate by numbers, if possible, the fact that brain-matter (after death) increases in hardness, with loss of its penetrable character, when maintained at the temperature of the body, and immersed in water or water containing alcohol. I therefore devised experiments with that object in view, but, although some important results were obtained, they were not of the sort sought for. I had expected that the hardening might be accompanied by an increase in the specific gravity, brought about by contraction, but, as will be evident on consideration, this need not necessarily take place, and in fact did not.

Experiment V.—The specific gravity of an ox brain removed from the skull a few hours previously = 1036. After being in water only at a blood-heat for five hours it had a specific gravity of 1007.

Experiment VI.—In another case an ox brain had a specific gravity of 1031; but after being in a solution of 38 per cent alcohol for five hours at blood-heat its specific gravity was only 1005, and on continuing the experiment for another five hours the specific grauity became 1007.

In Experiment V. the decrease in the specific gravity was brought out by swelling, for the weight of the brain had not materially altered, whereas in Experiment VI., where alcohol was used, the loss in specific gravity must have been introduced by the fixation of water, for the brain had gained materially in weight.

To sum up and conclude, it would appear from the results attending my investigation that alcohol has no more chemical effect on the brain-matter than water itself, so long as it is beneath a certain proportion to the total volume; but if that proportion be exceeded the brain principles, including kephaline, begin to dissolve and pass into solution, while the specific gravity of the brain is at the same time affected, both by the loss of matter and apparently the assimilation of more water. Meanwhile, water itself has a strong action on brain-matter, for it is capable of dissolving also certain principles slowly from the brain, for instance, cerebrine, myeline, &c., but no kephaline, and at the same time the brain-matter swells and attains a smaller specific gravity.

It is extremely hard to follow these ideas into life, and to comprehend in what way each or all of these modes of action of water and alcohol on the brain may be influenced by the other matters present in blood. Thudichum has shown that the state of the brain in life must vary according to every change in the state of the blood, and therefore what I have said of the action of water is probably true in life, in cases where the serum is very watery; but if the serum be rich in salts, those salts, by a power of combination which they have for the brain principles, would preserve the integrity of the latter. On the other hand, it is not so easy to see how any of the matters we know to exist in the blood could prevent alcohol, if it were present in sufficient quantity, either from hardening the brain or from dissolving traces of the principles to be henceforth carried away in the blood. If future physiological research should prove the absorption of alcohol to any extent by the brain, and its retention thereby, it would not be difficult to conceive, from what has gone before, how the alcohol would interfere with the life-functions of the brain and produce disease. Further researches are in hand.

In conclusion, I have the pleasure to acknowledge Dr. Thudichum's kindness in placing his laboratory at my disposal.

NOTICES OF BOOKS.

Cup and Platter, or Notes on Food and its Effects. By G. Overend Drewry, M.D., and H. C. Bartlett Ph.D., F.C.S. London: Henry King and Co., 1876.

"Cup and Platter" is a pleasantly written little volume giving much practical information on the subject of food and its effects on the human system. It is the joint work of Dr. Drewry, a well-known physician, who has specially devoted himself to the study and treatment of diseases of the digestive organs, and Dr. Bartlett, who is equally well known as one of our food analysts. Amongst the more prominent merits of this little work may be reckoned the sound common sense and candid courage with which it exposes many of the mischievous fallacies which at present pass current with regard to the nutritious properties of certain descriptions of food.

In the introduction the general properties of food products and the processes of their digestion and assimilation are clearly and succinctly described, and the chapters

which follow give a lucid account of the various descriptions of food in detail, the whole terminating with some excellent practical remarks on the scientific principles of cooking. In the chapter on water the remarks on filtering and filtering media are judicious, and the common error that a filter will last for an indefinitely long period is clearly pointed out. The authors dwell at considerable length on the pernicious effects of "previous sewage contamination" on drinking water, but their remarks on this subject might very well have been supplemented by a warning to their readers of the mischief arising from subsequent sewage gas contamination which, in ninety-nine cases out of a hundred, the water receives after it has found its way into the cistern. It is surely a waste of power and money to compel the different water companies to filter the water supplied by them to the public as long as householders are allowed to poison themselves and their families by using cisterns which are in direct communication with the house drain or water-closet through the waste-pipe. The next time that Dr. Drewry meets with a peculiarly puzzling case of derangement of the digestive organs we should advise him to ask his patient to allow him to look at his cistern as well as his tongue. In the following chapter the merits of condensed milk are rightly insisted on, and the authors' remarks on this valuable article of diet will do much to destroy the small amount of prejudice which still lingers among the public with regard to its wholesomeness. Messrs. Drewry and Bartlett, in the chapter on breadstuffs, are strongly in favour of the use of whole meal bread so as to receive the entire nutritive value of the wheat grain. The general public are hardly aware that the rage for white bread leads to the sacrifice of nearly 20 per cent of the flesh-forming constituents of the wheat. The thousand and one so-called farinaceous foods are very properly attacked at the end of this chapter. The pretensions which are contained in the advertisements of manufacturers of this class of foods have long been known by the merest tyro in dietetics to be false and mischievous, but the fallacy has never been so fully exposed as in the present work. In relation to this matter Dr. Harkwicke, the Coroner for West Middlesex, goes so far as to say that most of the deaths of infants under six months old arise from the use of corn flour and other kinds of starchy food. One of the largest firms in the trade coolly assert in their advertisement that when their corn flour is mixed with milk it closely resembles beef and bread! The vegetarian craze is reprobated, but we must take exception to one remark in which the authors give it as their opinion that "the cooling and laxative properties possessed by certain descriptions of fruit are those to which the greatest value must be attached." Surely the wholesome properties of the vegetable acids must have been overlooked when this paragraph was written. An eminent physician used to say that if each of his patients were to eat a couple of oranges before breakfast every morning he would lose half his practice. As a rule, we English, especially the middle classes, eat far too little fruit.

In the chapter on stimulants the ingenious action of the different aldehyds, ethers, and alcohols, other than ethylic alcohol, which are found in all new spirits are clearly pointed out. The little work concludes with some capital hints on cookery and kitchen management. We regret to see that Messrs. Drewry and Bartlett have thought proper to introduce the names of several well-known manufacturers of food products as having furnished them with "characteristic samples" of their manufactures. In a popular book like the present such "honourable mentions" savour too much of the puffing testimonial and ought to have been omitted.

Exercises in Electrical and Magnetic Measurement, with Answers. By R. E. Day, M.A. London: Longmans, Green, and Co., 1876.

Electrical students, more especially those who are weak in geometry and mathematics generally, usually find great difficulty in applying any of the systems of units at present in use to a variety of electrical and magnetic measurements. Even the expert scientific calculator is often at a loss when he finds it necessary to convert the results obtained by one system into those of another. Mr. Day's little manual will, we think, be useful both to the beginner and to the practised electrician. The book contains nearly seven hundred examples of exercises relating to every kind of electrical and magnetic measurement. Telegraphic testing, the measurement of magnetic force, resistance of conductors, induction and condensers, and electro-magnetic measurement, coming in for the lion's share of attention. Copious examples relating to liquid and battery resistance, shunts, and derived circuits, heating effects of currents, &c., are also given. The problems are preceded by a short preface giving an account of the system of units of measurement adopted by the Units Committee of the British Association, and known to electricians as the c.g.s., or centimetre-gram-second system, and showing how to convert a measurement founded on one system of units into a measurement founded on another. The units employed by practical electricians such as the ohm, the farad, the volt, &c., are also defined and explained. This part of the book might perhaps have been extended with advantage. The answers to the examples are appended, but we think that for the sake of the weaker portion of electrical students a few worked-out problems might have been given. For those who are commencing laboratory practice or who are preparing for actual work in connection with electric telegraphy, Mr. Day's little book will form a necessary complement to the excellent manuals of Culley, Sabine, and Everett.

CORRESPONDENCE.

SOLID WATER.

To the Editor of the Chemical News.

Sir,—Your readers will be amused with the following correspondence which has recently appeared in the *Athenæum* anent a communication on "Solid Water" which I made to the last meeting of the British Association:—

"Athenæum," *September* 23, 1876.

"Prof. Guthrie's note, 'On Solid Water,' was a description of what he formerly called 'cryohydrates,' aqueous solutions of various salts of such strength that when reduced to certain definite temperatures—all below 0° C.—the salt and the water solidify together. Surely there is nothing new in the fact of water becoming solid by associating with various compounds in their crystallisation? But of course a scientific man cannot go before the public at the British Association and not be sensational."

"September, 1876

"In the *Athenæum* for September 23 your reporter for the Chemical Section of the late meeting of the British Association, in noticing my communication on solid water as it exists in certain compounds, expresses himself as follows:—

"'Surely there is nothing new in the fact of water becoming solid by associating with various compounds in their crystallisation? But of course a scientific man cannot go before the public at the British Association and not be sensational.'

"To the first part of this expression I have only to say that I did not, and do not, pretend to be the discoverer of water of crystallisation as it is ordinarily understood. A great many salts (Epsom salts, blue vitriol, alum, &c.) were known, before your reporter and I were born, to contain water; but others (sal-ammoniac, saltpetre, &c.)

were only known in the anhydrous state. Now, I do pretend to have discovered the facts, whatever their importance may be, (1) that all crystalloid bodies soluble in water are capable, at temperatures below 0° C., of uniting with water to form solids containing definite quantities of water; (2) that the temperatures of solidification of these bodies, which I call cryohydrates, determine the limiting temperatures of freezing mixtures.

"With regard to the second part of your reporter's remark, namely, the accusation of sensationalism, I am constrained to say that it is as discourteous as it is unfounded, and I shall be glad to learn that, on reflection, your reporter regrets having allowed an expression of such questionable taste to have escaped him.

"FREDERICK GUTHRIE.

"*** Prof. Guthrie admits that he does 'not pretend to be the discoverer of water of crystallisation as it is ordinarily understood.' Well, but this 'water of crystallisation as it is ordinarily understood' is *solid* water, and we were therefore quite correct in maintaining there was nothing new in this. We never said that Prof. Guthrie had not discovered various salts which could, under certain circumstances, be got to crystallise with water, but we only found fault with the designation, which includes much more than Prof. Guthrie himself claims to have achieved. Surely the giving of such a designation justifies the charge of sensationalism."

"September 30, 1876.

"The remarks appended in the *Athenæum* of the 30th inst. to my note on your report of my communication to the British Association on 'Solid Water,' call for a word or two. You say:—

"'*** Well, but this 'water of crystallisation as it is ordinarily understood,' is *solid* water, and we were therefore quite correct in maintaining there was nothing new in this.'

"In what? That water of crystallisation as it is ordinarily understood is solid? Of course it is. I never dreamt of denying it. What I asserted, and conceive to be new, is that water may be solid and associated in definite proportions with salts, and yet not be water of crystallisation as it is ordinarily understood. It may either be such water or it may be the water of the cryohydrates. I used the term 'solid water' to include and because it includes both; and in my communication I spoke of both to discriminate between them. Can you suggest a more appropriate or less 'sensational' expression?

"The charge of sensationalism, which I regret to see not only not withdrawn but reiterated, may sometimes be permissible when brought against a writer of fiction; but to bring it on no better grounds than those adduced, against a writer on a scientific subject is injurious and unjust. You owe me an apology.

"FREDERICK GUTHRIE.

"*** We must decline to continue this controversy. There seems to be no difference as to *facts* between Prof. Guthrie and ourselves. We neither denied Prof. Guthrie the merit, if there be any, of having discovered the formation of solid water under particular circumstances, nor, as far as we are aware, have we imputed to him any desire of denying the existence of hydrates known before his researches. As to our suggesting a more appropriate designation for the class of bodies discovered by him—does Prof. Guthrie seriously believe this to be our concern? With regard to the title chosen by Prof. Guthrie for his paper at Glasgow, we have only to say that this is not a question of *fact* but of *taste*, and that upon it we shall continue to differ from Prof. Guthrie."

With a journal which, after transgressing in this manner, refuses to apologise when invited to do so I can, of course, hold no further communication. But your readers may permit me to state that there is no "controversy" in the case. I have endeavoured to inform the *Athenæum* in matters of fact, and I have resented the silly little insult which it has presumed to put upon the members of the British Association. I may add that I do "seriously" think it is the "concern" of a critic who takes exception to an expression, not only to point out how the expression is bad—if he can—but also to suggest a better one—if he can. The first of these duties the *Athenæum* has attempted and signally failed to perform. The second it declines to attempt because, forsooth, it is not its "concern."

From the assertion that the difference between the reporter or editor or whoever he is of the *Athenæum* and myself is only one of taste I must beg to dissent; or only agree to so far as I must admit that the misrepresentation of facts exhibits the worst possible taste.

Although, of course, one has to be serious in remonstrating with a journal devoted to "English and Foreign Literature, Science, the Fine Arts, Music, and the Drama," there is something exquisitely ridiculous in the notion of "Solid Water" being a "sensational" expression. "Hard Water" I presume is "Indelicate;" "Cold Water" is clearly "Atheistic;" and "Vapour of Water" should be avoided on high Æsthetic principles if we wish to avoid the imputation of "Cannibalism."—I am, &c.,

FREDERICK GUTHRIE.

PROF. DITTMAR AND THE "ANALYST."

To the Editor of the Chemical News.

SIR,—Had Mr. Wanklyn paused to make a few enquiries before writing to you, he would not, I am sure, have dragged my name into this discussion, because he would have found that at the time the *Analyst* published the article and report which originally gave him offence, I was enjoying a ramble in Switzerland, and I can safely say never wasting a thought either on butter or Mr. Dittmar. In fact Mr. Wanklyn and myself have precisely the same amount of responsibility for the contents of the *Analyst* for September, viz., *that we were both members of the Committee of Publication, and that we each of us neglected our obligations as such, and stayed away from the meeting*, and therefore we ought to be the last to throw stones at those who did their duty by attending.

My position as one of the "registered proprietors" of the paper was simply taken to get the Society out of the difficulty that, not being corporate, they could not legally hold a copyright, and I will have much pleasure in handing over the position (involving, as it does, pecuniary responsibility) to any other member who may be public spirited enough to accept it. I trust Mr. Wanklyn will withdraw his remarks so far as I am personally concerned.—I am, &c.,

JOHN MUTER.

South London Central Public Laboratory,
Kennington Cross, S.E., October 7, 1876.

ON THE PRESENCE OF ARSENIC IN THE VAPOURS OF BONE MANURE.

To the Editor of the Chemical News.

SIR,—The pamphlet published by Dr. Adams on the above subject has occasioned some discussion in the CHEMICAL NEWS, and in your number of September 22nd, there is a note which seems to suggest a doubt whether the chemists who made experiments for Dr. Adams had previously satisfied themselves of the purity of their reagents.

I may state that I was expected to give evidence in the particular case referred to in the pamphlet, and that I not only made "blank experiments" when originally consulted by Dr. Adams, but made them again in his presence when he came to my laboratory to see the experiments repeated.

Considering the abundant evidence adduced by Dr. Adams, I think it may reasonably be conceded that

arsenical vapours are given off during the action of arsenical sulphuric acid on bones or coprolites. On the medical question involved I have no opinion to offer.—I am, &c.,

Alex. T. Machattie.

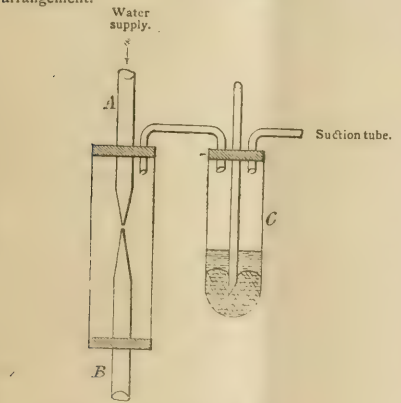
83, Hope Street, Glasgow.

[We have also received a long communication on this subject from Dr. Adams, and a further letter from Dr. Milne stating that blank experiments were made. This fact should, in our opinion, have been stated more explicitly in the book. We can devote no more space to the subject, it being contrary to our custom to insert letters referring to our reviews of books, unless, indeed, they point out a manifest injustice to the author, and this we do not admit to have been the case in the present instance.—*Ed.* C.N.]

IMPROVED FORM OF ASPIRATOR.

To the Editor of the Chemical News.

Sir,—In the Chemical News (vol. xxxiv., p. 141) Mr. Richards describes an "Improved Form of Aspirator." This is somewhat similar in principle to one I constructed about four months ago, the chief difference being that Mr. Richards's pump requires a water pressure of 20 pounds to the square inch to exhaust "to within 1 m.m. of the tension of aqueous vapour," while mine takes less than 5 pounds only to produce a vacuum (less, of course, by the tension of aqueous vapour.) I append a drawing of my arrangement.



The tubes A B are of glass, and placed diametrically opposite each other, so that the water issuing from the jet A passes smoothly down through B. C is a mercury governor, to regulate the pressure when the pump is used for filtering purposes. The rapidity with which this pump exhausts is very great.

The principle involved was fully discussed and illustrated in a paper to the *Engineer* of June 9, 1876, by Mr. James Brownlee.—I am, &c.

A. Percy Smith.

Rugby, October 2, 1876.

Action of Nitrous Acid upon Acetanilide.—Otto Fischer.—On passing a current of nitrous acid into a refrigerated solution of acetanilide in acetic acid until the liquid becomes green there is obtained, on pouring the solution into a large quantity of water, a yellowish precipitate which possesses the composition and characteristics of nitroso-acetanilide.—*Moniteur Scientifique.*

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances, de l'Academie des Sciences. No. 12, September 18, 1876.

Lighting by means of Products Extracted from Resinous Trees.—M. A. Guillemare.—The author remarks that if an attempt is made to burn in a common lamp, adapted for oil of colza or petroleum, either oil of turpentine, "essentia viva," or the oil known as pyrogene (the two latter being extracted from resin by fractional distillation over 4 per cent of quicklime), two difficulties are met with which have hitherto proved insurmountable. The resinous liquids of commerce only rise into the wick for a few minutes, after which the capillary action slackens considerably and soon stops. In all the lamps of commerce these same liquids burn imperfectly and diffuse an intense smoke. It is therefore needful to purify them perfectly, and to contrive a special jet or burner for their use. The clogging of the wick is due to the presence of resin or of naphthalen in solution. These impurities are removed by distillation over an equal volume of water rendered slightly alkaline, a current of steam being passed through the apparatus, and by exposing the oils to the direct and prolonged action of concentrated solutions of alkaline carbonates. The oils may be regarded as perfectly pure when they are no longer rendered milky by the addition of ammonia. A new burner has been devised, the construction of which is not quite clear, but which is said to prevent the formation of smoke.

Physical Properties of Gallium.—M. Lecoq de baudran.—Inserted in full.

Justus Liebig's Annalen der Chemie, Band 182, Heft 3.

Investigations on Bodies of the Hydrobenzo and Stilben Series.—T. Zincke.—An introduction to th next paper.

Various Hydrobenzoins, or Stilben Alcohols.—C Forst and T. Zincke.—A very bulky essay, extending 50 pages, and unfit for abstraction.

Apparatus for the more Convenient Determination of Nitrogen.—Karl Zulkowsky.—An improved instrument for the determination of nitrogen by the method of Dumas, calculated to be of great value in laboratories where such determinations are frequent. The apparatus cannot be described in an intelligible manner without the aid of the accompanying illustration.

On Ultramarine.—Dr. Carl Bœttinger.—It has always been assumed that the formation of the blue colour of ultramarine depends on the action of oxygen: but in cracked crucibles and on the edges of the blue mass white products are often observed, which, on washing with water, lose almost all their sulphur in the form of sulphate. That this phenomenon is due to oxidation seems to require no further proof. Hence, then, it appears that the colour is destroyed by oxidation. In the author's opinion ideal ultramarine is a compound of silicate of alumina and soda with pentasulphide of sodium.

Communications from the Chemical Laboratory of the University of Moscow.—These communications include a paper by W. Markownikoff on isomeric tartaric acids, and one by the same author on the normal oxypyro-tartaric acid (glutanic acid), and the isomerism of the pyrocitric acids: an account of the preparation of trimethylen-bromide, by J. Lermontoff; on aceton in the urine of diabetic patients, by W. Markownikoff; on certain constitnents of *Adonis vernalis*, by F. Linderos; and a preliminary communication on isomeric dibrom-anthracen, by Oswald Miller.

Contributions to the History of Betulin.—U. Hausmann.—The composition of betulin is—

Carbon	80·00
Hydrogen	11·11
Oxygen	8·89
	100·00

corresponding to the formula $C_{12}H_{20}O$. In a state of purity it is colourless, and forms long slender prisms, which are readily converted by pressure into shining asbestos-like masses. It melts at 258°. At a slightly higher temperature it is volatilised with incipient decomposition, and sublimes in long delicate needles.

Les Mondes, Revue Hebdomadaire des Sciences, No. 4, September 28, 1876.

Adulteration of Wines.—The author remarks that so long as falsification consisted merely in heightening the colour of wines with logwood and other vegetable matters it was only a semi-evil, though still considerable enough, since one of the dyes most commonly used was a drastic purgative. But magenta has now come into use on a scale scarcely to be imagined. A small commune in the neighbourhood of Béziers, containing only 1800 inhabitants, has consumed in one year 30,000 francs worth of this colour entirely for sophisticating wines.

MISCELLANEOUS.

Birmingham and Midland Institute.—The following are the lecture arrangements for the session 1876-7 :—

This day (Friday), October 13.—Lieut. Cameron, D.C.L., on "Recent Explorations in Africa."

October 16.—Captain Davis, R.N., F.R.G.S., on "Antarctic Discovery, and its Connection with the Transit of Venus, 1882.

October 23, 30.—Prof. W. C. Williamson, F.R.S., on "The Early Forms of Animal Life," and "The Early Forms of Vegetable Life."

November 6, 13.—George Dawson, M.A., on "Horace Walpole."

November 20.—Wm. Huggins, D.C.L., LL.D., F.R.S., on "Spectrum Analysis Applied to the Heavenly Bodies."

November 27, December 4.—Arthur Arnold, on "Persia."

December 11.—Prof. Boyd Dawkins, M.A., F.R.S., F.S.A., on "The Ancient Inhabitants of the Caves of Derbyshire."

January 22, 29.—E. Ray Lankester, M.A., F.R.S., on "Rots and Ferments, our Unseen Enemies."

February 5, 12.—Edward Dannreuther, on "The Pianoforte Works of Liszt and Chopin."

February 19, 26.—Prof. Sidney Colvin, M.A., on "Olympia and Greek Athletics; a Study of Ancient Usages and Recent Discoveries."

March 5.—Prof. J. M. D. Meiklejohn, M.A., on "Parody."

March 12.—Prof. Sir C. Wyville Thomson, LL.D., F.R.S., on "The General Results of the Challenger Expedition."

March 19, 26.—Prof. W. Barrett, F.R.S.E., on "Radiation and Radiometers."

April 9, 16.—George Dawson, M.A., on "Sir Walter Raleigh."

NOTES AND QUERIES.

*** Our Notes and Queries column was opened for the purpose of giving and obtaining information likely to be of use to our readers generally. We cannot undertake to let this column be the means of transmitting merely private information, or such trade notices as should legitimately come in the advertising columns.

Fluoride of Potassium.—Can any of your readers give me a process for the ready production of fluoride of potassium.—FLUORINE.

An Analytical Query.—In separating arsenic, &c., from copper, &c., by treating with an alkaline sulphide, I generally get the filtrate rather dark, and it seems to contain not copper in solution, but finely divided. I believe there is a way of preventing even a slight trace of copper getting through. I have looked at many analytical works but have failed to see anything about it, except the diluting, but that I have always done. I have taken in the CHEMICAL NEWS for years but have never seen anything on the subject.—ROBERT MONGER.

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Early in October.

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Professor E. J. MILLS, Dr. Sc. (Lond.), F.R.S.

SESSION 1876-7.

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LABORATORIES.—The Laboratories will be Open Daily, on and after Wednesday, 1st November, from 10 a.m. to 4 p.m. (Saturdays 10 a.m. to 1 p.m.), under the Superintendence of the Professor and his Assistants. Instruction given in the Preparation of Chemical Substances and Original Research, especially as relating to Manufacturing Processes. Fees—Whole Session of Nine Months, £18: Six Months, £13: Three Months, £7, or for One Month, £3 10s.

Students entering upon Laboratory Instruction are required have a fair knowledge of Elementary Chemistry.

BURSARIES.—A Few Bursaries of £50 each per Annum, Tenable for Three Years, are now at the disposal of the Trustees, who will receive Applications in writing up to the 18th October.

ALEX. MOORE, Secretary.

166, St. Vincent Street, Glasgow,
October, 11, 1876.

THE CHEMICAL NEWS.

Vol. XXXIV. No. 882.

ON REPULSION RESULTING FROM RADIATION.—PART II.*

By WILLIAM CROOKES, F.R.S., &c.

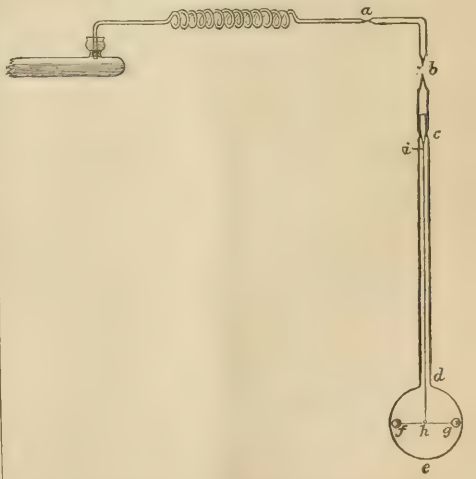
81. The present paper is in continuation of one which I had the honour of reading before the Royal Society, December 11, 1873, and which was published in the *Philosophical Transactions*, vol. clxiv., part 2, p. 501. In that paper I described various pieces of apparatus, chiefly in the form of delicate balances suspended in glass tubes, by means of which I was enabled to show attraction or repulsion when radiation acted on a mass at one end of the beam, according as the glass tube contained air at the normal pressure, or was perfectly exhausted. At an intermediate internal pressure the action of radiation appeared *nil*. Towards the end of the paper I said (70), "I have arranged apparatus for obtaining the movements of repulsion and attraction in a horizontal instead of a vertical plane. Instead of supporting the beams on needle-points, so that they could only move up and down, I suspend them by the centre to a long fibre of cocoon silk in such a manner that the movements would be in a horizontal plane. With apparatus of this kind, using very varied materials for the index, enclosing them in tubes and bulbs of different sizes, and experimenting in air and gases of different densities up to Sprengel and chemical vacua, I have carried out a large series of experiments, and have obtained results which, whilst they entirely corroborate those already described, carry the investigation some steps further in other directions."

82. I have introduced two important improvements into the Sprengel pump† which enable me to work with more convenience and accuracy. Instead of trusting to the comparison between the barometric gauge and the barometer to give the internal rarefaction of my apparatus, I have joined a mercurial siphon-gauge to one arm of the pump. This is useful for measuring very high rarefactions in experiments where a difference of pressure equal to a tenth of a millimetre of mercury is important. By its side is an indicator for still higher rarefactions; it is simply a small tube having platinum wires sealed in, and intended to be attached to an induction coil. This is more convenient than the plan formerly adopted (51) of having a separate vacuum tube forming an integral part of each apparatus. At exhaustions beyond the indications of the siphon-gauge I can still get valuable indications of the nearness to a perfect vacuum by the electrical resistance of this tube. I have frequently carried exhaustions to such a point that an induction spark will prefer to strike its full distance in air rather than pass across the $\frac{1}{4}$ inch separating the points of the wires in the vacuum tube. A pump having these pieces of apparatus attached to it was exhibited in action by the writer before the Physical Society, June 20, 1874.

83. The cement which I have found best for keeping a vacuum is made by fusing together 8 parts by weight of resin and 3 parts of bees'-wax. For a few hours this seems perfect, but at the highest exhaustions it leaks in the course of a day or two. Ordinary or vulcanised india-rubber joints are of no use in these experiments, as when the vacuum is high they allow oxygenised air to pass through as quickly as the pump will take it out. Whenever possible the glass tubes should be united by fusion, and where this is impracticable mercury joints should be used. The best way to make these is to have a well-made conical stopper, cut from plain india-rubber, fitting into the wide funnel tube of the joint and perforated to carry the narrow tube. Before fitting the tubes in the india-rubber, the latter is to be heated in a spirit flame until its surface is decomposed and very sticky; it is then fitted into its place, mercury is poured into the upper part of the wide tube so as to completely cover the india-rubber, and oil of vitriol is poured on the surface of the mercury. When well made this joint seems perfect; the only attention which it subsequently requires is to renew the oil of vitriol when it gets weakened by absorption of aqueous vapour. Cement has to be used when flat glass or crystal windows are to be cemented on to pieces of apparatus, as subsequently described (99, 102).

It would be of great service could I find a cement which is easily applied and removed, and will allow the joint to be subjected to the heat of boiling water for some hours without leaking under the highest rarefactions. Hitherto I have failed to find one which answers these requirements. I mention this in the hope that some one who happens to read this may be in possession of the recipe for such a cement, and will communicate it to me.

84. Before my first paper on this subject was read before the Royal Society I had discarded the balance form of apparatus there described, and commenced experimenting with bulbs and tubes in which quantitative results could be obtained. On December 11, 1873, when illustrating my paper, I exhibited to the Society many of these new forms of apparatus. For the purposes of simple illustrations, and for experiments where quantitative determinations are not required, I find a horizontal index suspended in a glass bulb the most convenient. The apparatus, with its mode of attachment to the pump, are shown in fig. 1.



a, *b*, *c*, *d* is originally a straight piece of soft lead-glass tubing 18 inches long, $\frac{5}{8}$ of an inch external and $\frac{3}{8}$ internal diameter. At one end is blown a bulb, *d e*, about 3 inches diameter. The part *a b* of the tube is drawn out to about half its original diameter, and bent at right angles. The tube is slightly contracted at *c*, and very much contracted and thickened at *b*. At *a* it is also contracted and cemented by fusion to a narrower piece of tube bent in the form of a spiral, and fitting by a mercury joint into the

* From the *Philosophical Transactions of the Royal Society of London*, vol. clxv., pt. 2.

† *Philosophical Transactions*, 1873, vol. clxiii., p. 295; 1874, vol. clxiv., pp. 509, 516. *Phil. Mag.*, August, 1874.

sulphuric acid chamber of the pump. The object of the spiral is to secure ample flexibility for the purpose of levelling the apparatus, and at the same time having a fused joint. *f g* is a very fine stem of glass, drawn from glass tubing, and having a small loop (*h*) in the middle. At each end of the stem is a ball or disk, made of pith, cork, ivory, metal, or other substance. *h i* is a fine silk fibre made from split cocoon-silk; it is cemented by shellac at the upper end to a piece of glass rod a little smaller in diameter than the bore of the tube, and drawn out to a point, as shown. The contraction (*c*) in the tube is for the purpose of keeping this glass rod in its place; when properly adjusted it is secured in its place by a small piece of hot shellac, care being taken not to cement the rod all round, and so cut off the connection between the air in the bulb and that in the upper part of the tube. The silk fibre is tied on to the loop of the glass stem at *h*. The length of the fibre is so adjusted that the stem and disks will hang about $\frac{1}{8}$ of an inch below the centre of the bulb; that much having to be allowed for the contraction of the silk when the air is exhausted.

85. The bulb-tube is firmly clamped in a vertical position, so that the index hangs freely, and the pump is set to work, the bulb being surrounded with a vessel of water which is kept boiling all the time exhaustion goes on. The gauge soon rises to the barometric height; but the operation must be continued for several hours beyond this point in order to get the best effects. If the bulb is not heated during the exhaustion, the index loses sensitiveness after it has been sealed up for a few days, probably owing to the evolution of vapour from the pith; when, however, the precaution is taken of heating the pith the apparatus preserves its sensitiveness. On this account it is necessary to tie the silk on to the loop in the centre of the glass stem, instead of adopting the easier plan of cementing it with shellac. During the later stages of the exhaustion, oil of vitriol (which has been boiled and cooled *in vacuo*) should gently leak into the pump through the funnel-stopper at the top of the fall-tube (44). This covers each globule of mercury as it falls with sulphuric acid, and stops mercury vapour from getting into the apparatus.* I cannot find that any vapour is evolved from oil of vitriol.

When the exhaustion is carried to the desired degree a spirit flame is applied to the contracted part of the tube at *a* (fig. 1), and it is sealed off. The apparatus is then unclamped and the tube is again sealed off at *b*. This double operation is necessary to secure strength at the final sealing, which can only be got by holding the tube horizontally and rotating it in the flame, watching the glass to prevent it softening too suddenly.

86. The best material of which to form the index in these bulb-tubes is pith, either in the form of a needle or bar, or as disks at the end of a glass stem. On December 11, 1873, and again on April 22, 1874, I exhibited before the Royal Society a glass bulb 4 inches in diameter, having suspended in it a bar of pith $3\frac{1}{2} \times \frac{1}{4}$ inches. It had been exhausted in the manner above described; and so sensitive was it to heat, that a touch with the finger on a part of the globe near one extremity of the pith would drive the bar round 90°, whilst it followed a piece of ice as a needle follows a magnet.

To get the greatest delicacy in these apparatus there is required large surface with a minimum of weight (75, 76). Thin disks of pith answer these requirements very satisfactorily; but I have also used disks cut from the wings of butterflies and dragonflies, dried and pressed rose-leaves, very thin split mica and selenite, iridescent films of blown glass, as well as the substances mentioned in my former paper (25). Quantitative experiments to prove this law were attempted; but the bulb apparatus was found too imperfect for accurate measurements, so another form was devised which will be described further on (102), together with the experiments tried with it.

(To be continued.)

* By adopting this precaution it is not difficult to raise the mercury in the gauge higher than that in the very perfect barometer by its side, the latter being somewhat depressed by the tension of mercury vapour.

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 149.)

Chlorine, Bromine, Iodine, and Fluorine.
By Dr. E. Mylius, of Ludwigshafen.

As leaden worms are very rapidly destroyed by liquid bromine, though very slightly attacked by bromine vapours, Frank† employs condensing tubes of earthenware. To separate the bromine from the chloride of bromine simultaneously evolved he avoids a too perfect refrigeration, and conducts the more volatile products, including the chlorine, into a receiver charged with iron-turnings or with potash-lye. The crude bromine in the first receiver is then completely freed from chlorine and from sparingly volatile organic bromides which are usually present by fractionated distillation.

Several methods for obtaining the bromides of the alkalies and alkaline earths deserve notice. Henner and Von Hohenhausen‡ prepare the bromides of calcium, barium, and strontium by diffusing the respective hydrates in water, decomposing with bromine, evaporating till the formation of crystals begins, and mixing the liquid with alcohol, which precipitates the last portion of the bromate formed. The bromide is then obtained from the liquid, and a further portion is procured by heating the bromate with charcoal. C. Wendler‖ proposes to prepare the bromides of the alkaline earths according to Rud. Wagner's approved method for the manufacture of the corresponding iodides, *i.e.*, by the action of bromine upon the sulphites.

According to A. Faust§ Bœdeker obtains the bromides as follows:—Bromide of sulphur is prepared from 20 parts flowers of sulphur and 240 parts of bromine, and gradually poured into the milk of lime made from 140 parts of quicklime, or into a corresponding solution of baryta. The bromide of sulphur in contact with the hydrate of the alkaline earth is decomposed into a metallic bromide and a sulphate. The latter is removed by the addition of alcohol and subsequently of lime. The solution of calcic or baric bromide can either be used for obtaining those salts, or for preparing the sodic, potassic, or ammonic bromide by decomposition with the corresponding carbonate or sulphate.

Casthelaz¶ prepares bromide of sodium by forming, in the first place, bromide of ammonium by dropping bromine into liquid ammonia, and decomposes this by the addition of an equivalent quantity of caustic or carbonated soda.

Falières points out** that iodine present in bromide of potassium may be removed by agitation with free bromine.

Of all these methods of preparing bromides, especially bromide of potassium, which is most in use, none is practised on the large scale. Either the ferroso-ferric bromide is decomposed by the addition of carbonate of potassa, or vapours of bromine are conducted into potash-lye, and he potassic bromate formed along with potassic bromide

* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzehends."
† Private communication.
‡ Henner and Hohenhausen, *Dingl. Pol. Journ.*, clxxiii., 1864, 221.
‖ C. Wendler, *Wagner Jahresber.*, 1863, 201.
§ A. Faust, *Archiv d. Pharm.*, clxxxi., 216. *Wagner Jahresber.*, 1867, 196.
¶ Casthelaz, *Mont. Scient.*, 1870, 65. Chemical News, 1870, No. 532, 58; and 547, 258. *Wagner Jahresber.*, 1870, 195.
** Falieres, *Wagner, Jahresber.*, 1872, 274.

is decomposed by ignition with charcoal powder. The preparation of bromide of potassium and the bromides of iron is conveniently combined with the manufacture of bromine. Since 1867 Franck condenses bromine in a set of three Woolff's bottles, the first of which, slightly cooled, receives liquid bromine, whilst the second contains bromide of potassium or ferrous bromide, and the third potash-lye or iron-turnings. The chloriferous bromine vapours escaping from the first slightly cooled receiver pass through the solution of bromide and are freed from their chlorine, in the place of which bromine escapes from the bromides and arrives in a pure state into the iron-turnings or the potash-lye contained in the third bottle, in which pure bromides are at once obtained.

We have already mentioned that a large proportion of bromide of potassium is obtained from the ferroso-ferric bromide. The manufacturers of bromide of potassium are not under the necessity of preparing the iron compound themselves from condensed bromine. It is obtained at the Stassfurt bromine works, and is sold in the form of a paste containing from 65 to 70 per cent of bromine. As it can be packed in vessels of stoneware and tinned iron and even in wooden casks, it is the most convenient form for the carriage of bromine, which, in the free liquid state, is difficult to pack and dangerous to convey.

(To be continued).

ACTION OF PHOSPHINE (PH_3) ON MERCURIC CYANIDE ($HgCy_2$).

When pure phosphine is passed into a solution of $HgCy_2$ in water or alcohol the gas is absorbed, a pale yellow precipitate is formed, and hydrocyanic acid (HCy) is evolved. This yellow precipitate quickly turns black on warming or exposure to sunlight, with partial reduction to metallic mercury. The alcoholic solution yields a better product than the aqueous solution, the precipitate being of a much brighter yellow colour, and not decomposing quite so rapidly as that formed in the aqueous solution.

It is so sensitive to light that it was found impossible to dry it, even *in vacuo*, without change of colour in the superficial portions. After drying for thirty hours *in vacuo* over oil of vitriol, a sample had a surface-colour greenish black, the under part being still yellow. Quantitative analysis shows it to contain Hg, P, Cy, and H.

When heated in contact with the atmosphere it ignites at about 90° C., undergoing a kind of smouldering combustion, a residue of phosphoric acid, mercury, and some difficultly combustible carbonaceous matter containing nitrogen, (probably "para-cyanogen") being left. When heated in tube a little cyanogen gas and a phosphuretted hydrogen are given off, a residue of mercury and phosphoric acid, with carbonaceous matter, remaining.

The substance is oxidised by nitric acid, but dilute HCl and sulphuric acid do not seem to affect it.

Carbon, hydrogen, and mercury combustions have given the following figures:—

	A. Per cent.	B. Per cent.
C	1·65	1·48
Hg	84·72	84·76
H	4·30 (?)	—
Phosphorus ..	5·47	—
Nitrogen	5·00 (nearly)	(soda-lime comb.)

W. R. H.

Royal College of Chemistry.

ARSINE AND MERCURIC CYANIDE.

A precipitate is also produced by arsine (AsH_3) in alcoholic solution of $HgCy_2$, which has a red-brown colour, and is also rapidly affected by light, but not quite so easily as the phosphine compound.

The precipitate produced by arsine in the water solution of mercuric cyanide is very unstable, decomposing in a few hours into Hg and arsenious and hydrocyanic acids at the ordinary temperature. The precipitate is so finely divided that it passes completely through filter-paper. Stibine appears to be a still more energetic reducing-agent on mercuric cyanide than phosphine or arsine; a rapid stream of stibine (SbH_3), prepared from (Sb_2Zn_3), producing a precipitate of metallic mercury in either aqueous or alcoholic solutions.

W. R. H.

Royal College of Chemistry.

NEW METHOD FOR ASCERTAINING THE EXACT QUANTITY OF PURE ANTHRACEN CONTAINED IN CRUDE ANTHRACEN.

By MEISTER, LUCIUS & BRÜNING.

The experience gained during the last few years with regard to anthracen testing has induced us to abolish our old test of October, 1873, and the appendix of 1874, and to issue a new and improved method, as follows:—

Take 1 grm. of anthracen, place it in a flask with condenser of 500 c.c. capacity, add to it 45 c.c. of glacial acetic acid, and heat to ebullition. To this solution (which is kept boiling) add, drop by drop, a solution of 15 grms. of chromic acid in 10 c.c. of glacial acetic acid and 10 c.c. of water.

The addition of the chromic solution should occupy two hours; after which the liquid is to be kept boiling for two hours longer, four hours being required to complete the oxidation.

The flask with its contents is to be kept standing for twelve hours, then mixed with 400 c.c. cold water,* and again kept standing for another three hours.

The precipitated anthraquinon is now collected on a filter, and washed first with pure water, then with boiling dilute alkaline solution, and finally with pure hot water. The quinon is now washed from the filter into a dish, and dried at 100° C. It is then mixed in the same dish with ten times its weight of fuming sulphuric acid of 68° Baumé (sp. gr. 1·88), and heated to 100° C. for ten minutes on a water-bath. The quinon solution thus obtained is poured into a flat dish, and kept for twelve hours in a damp place to absorb water.

Then add 200 c.c. of cold water to the contents of the dish, collect the precipitated quinon on a filter, and wash first with pure water, then with boiling alkaline solution, and finally with pure hot water.

The anthraquinon is now placed in a dish, dried at 100° C., and weighed. After volatilising the quinon by heating the dish, it is weighed, with the particles of coal and the ash.

The difference between the two weights gives the weight of anthraquinon obtained, and it is to be calculated in the usual manner into anthracen.

Hoechst, a. M., October, 1876.

Prize in Industrial Hygiene.—An offer of a medal in connection with this subject has been made by Mr. Benjamin Shaw, and has been accepted by the Council of the Society of Arts. The medal will be of the value of £20, and will be awarded every fifth year. The terms of the offer are as follows:—"For any discovery, invention, or newly-devised method for obviating or materially diminishing any risk to life, limb, or health, incidental to any industrial occupation, and not previously capable of being so obviated or diminished by any known and practically available means." The first award will be made in May, 1877. The latest date for receiving communications will be March 31, 1877.

* The increased quantity of water added ensures the complete precipitation of the anthraquinon, and the correction formerly made is no longer necessary.

NOTES OF WORK BY STUDENTS OF PRACTICAL CHEMISTRY IN THE LABORATORY OF THE UNIVERSITY OF VIRGINIA.

No. V.

Communicated by J. W. MALLET,
Professor of General and Applied Chemistry in the University.

(Continued from p. 149.)

(2.) *Chemical Examination of Füh-ling (Lycoperdon solidum) from China.* By J. L. KELLER, of Charlottesville, Virginia.

Among a number of interesting specimens which Mr. Justus Eck, of London, was kind enough to present, some two or three years ago, to the laboratory collections of this University, was one of this curious material, accompanied by the following extract in reference to it from the late Mr. D. Hanbury's "Notes on Chinese Materia Medica :"—

"Füh-ling; *Pachyma cocos*, Fries (*Fungi*); *Lycoperdon solidum*, Gronovius; Pé-fo-linn, Cleyer (*Med. Sin.*, No. 189), Tafarinov (*Cat. Med. Sin.*, pp. 2—23); Puntsaon; Indian Bread; or Tuckahoe. A very large remarkable substance resembling ponderous rounded tubers having a rough blackish brown bark-like exterior, and consisting internally of a compact mass of considerable hardness, varying in colour from cinnamon brown to pure white. These tuberiform bodies, which in weight vary from a few ounces up to several pounds, are found attached to the roots of fir trees, or sometimes buried in the ground of localities where firs no longer grow. They occur in South Carolina,* in some of the northern and western provinces of China, and in Japan. Their true nature is sufficiently perplexing. The older writers considered them to be a sort of China root (*Smilax*), a supposition which their outward appearance certainly favours, but which is immediately negatived when we find them to contain no trace of starch. Loureiro and Endlicher are content to describe them as tubers found upon the roots of fir trees. Other botanists have placed them among fungi; Gronovius and Walter in the genus *Lycoperdon*; Schweinitz in *Scleroticum*; Okur and Fries in *Pachyma*. The latest observations on the subject are some which were submitted to the Linnean Society by Mr. F. Currey and myself last year (1861) and published in the *Linnean Transactions*. The opinion there expressed is that these tuber-like bodies are an altered state of the root of the tree, probably occasioned by the presence of a fungus, the mycelium of which traverses, disintegrates, or even obliterates the wood and bark. This mycelium appears under the microscope in the form of fine threads usually more or less mixed with bodies of irregular shape, somewhat resembling starch granules, but which are apparently cells of the woody tissue in a more or less advanced state of disease and distortion. Nothing is known of the more developed form of the fungus represented by the mycelium. The American Füh-ling has been examined chemically by Professor Ellett, of South Carolina College, who has stated it to consist entirely of pure pectine of Braconnot, but I think its composition deserves some further investigation. I find that the pure white internal substance (which is quite insipid and inodorous) is very slightly soluble in cold rectified spirit and in cold water, and not more so when boiled in water, the solution in each case yielding a flocculent precipitate with acetate of lead. When boiled in a weak solution of carbonate of soda the substance dissolves rather more freely, and the solution affords a scanty gelatinous precipitate (pectic acid) when treated with an acid, or (pectate of lime) with a solution of lime. In China the Füh-ling is made into edible cakes, which are frequently sold in the streets; it is also reported medicinal in a variety of disorders. In America it has also been used as an article of food, whence the name Indian bread."

The *Report of the U. S. Department of Agriculture* for 1870 (p. 423), in an article upon materials used as food by the North American Indians, has the following notice of this substance :—

"*Tuckahoe or Indian Bread* (*Lycoperdon solidum*).—Two specimens of this fungus are in the collection of the Department of Agriculture—one from Nottoway Co., Virginia (fig. 1, plate 10), and the other from Leroy, Kansas (fig. 2, plate 10). These singular fungous growths are subterranean and parasitic on the roots of large trees. A piece of root is often inclosed in the mass. The form is irregularly globose, about the size of a man's head. It is very rugous and filled with cracks; the colour externally is ashy black, in the interior white or nearly so, of a starchy appearance, very firm, and breaks into irregular masses. The Kansas specimen is rounded in shape, with a black, rough exterior, and a white and compact interior. When broken it has the appearance of a mass of dried dough, full of fissures and very granular. Booth and Morfit's *Cyclopædia of Chemistry* gives the following under the article of 'Picquotaine,' a highly nutritious plant used as food by Indians. It results from a disease of the *Psoralea esculenta*. Its composition is as follows:—Nitrogenous matter, 4·09; mineral substances, 1·61; starch, 81·80; water, 12·50." The following remarks relative to the Tuckahoe are furnished by Dr. John Torrey :—'It was first brought to the notice of the public by Dr. Clayton, who sent it to Gronovius under the name of *Lycoperdon solidum* and as such described it in the *Flora Virginica* about one hundred and twenty years ago. Next it was described by the late Dr. von Schweinitz, in his "Synopsis of the Fungi of North Carolina," under the name of *Scleroticum cocos*. About the same time Dr. Macbride, of Charleston, South Carolina, sent to the Linnean Society of London his observations on that fungus. Without being aware of having been anticipated by Schweinitz I described it in the New York Repository about the year 1819, under the name of *Scleroticum giganteum*. I gave also a chemical analysis of it, showing that it is chiefly composed of a singular substance which I named sclerotine. Braconnot some years after this described the same principle, which he called pectine. In the *Synopsis Fungorum* of Fries, the fungus is called *Pachyma cocos*. In the *Proceedings of the Linnean Society of London* is an account by Rev. M. J. Berkeley of a large subterranean fungus that is sold as food in the streets of Shanghai, undoubtedly the same as the Tuckahoe."

And in the *Report* of the same Department for 1871 (p. 98) occurs the following from R. T. Brown, Chemist to the Department :—

"*Tuckahoe or Indian Bread.*—This curious fungus (*Sclerotium giganteum*) is quite common in many parts of the Southern States, where it is frequently used as an article of food.* To determine its nutritive value a specimen from Columbia, Virginia, was subjected to careful analysis in this Laboratory, with the following results:—

"Moisture	14·16
"Glucose (fruit sugar)	0·93
"Gum	2·60
"Pectose	17·34
"Nitrogen in an insol. combination	0·36
"Woody fibre	64·45
"Ash	0·16
	100·00

* They are by no means peculiar to this State. I have seen specimens found at various points from Virginia to Alabama on the Atlantic side of the country, and, as will be seen by the quotation from *Report of the Department of Agriculture*, they extend as far west as Kansas.

* This is certainly an over strong way of stating the facts. Specimens of the material in question are not very rare, and they are

"This analysis does not sustain the high reputation of this substance as a food material."

The substance received from Mr. Eck being from China, while all the above statements as to chemical composition refer to material from America, and these statements differing so widely from each other, it seemed well to make a new analysis, which was done by Mr. Keller.

The specimen of Chinese Füh-ling examined was kidney-shaped, about 6 inches in longest diameter, and 3½ inches in shortest, and weighed about two pounds and a quarter. The rough, brownish black, bark-like exterior was about an eighth of an inch thick, verging gradually into the perfectly white uniform mass inside. The whole was compact and firm, but easily cut with a saw, and the fragments, after removal of the exterior crust, shewed but little toughness and were easily crushed in a pestle and mortar. A sufficient quantity was reduced to fine powder, passed through a sieve, and thoroughly mixed. This powder yielded little soluble matter to either cold or hot water, but was much more freely dissolved by a dilute solution of hydrate or carbonate of sodium, the liquid produced in each case giving a flocculent gelatinous precipitate (corresponding in character to pectic acid) when treated with an acid or alcohol, such precipitate proving excessively difficult to wash. Starch and cane-sugar were carefully tested for, but none could be found.

The quantitative analysis was made as follows:—Water was determined by prolonged exposure to 110° C.; albuminoid matter was calculated from the amount of nitrogen, determined by combustion with soda lime. For the organic matters soluble in water the powder was exhausted with water by repeated boiling, keeping the flask full of steam so as to exclude air; the liquid rapidly filtered, and evaporated (in a retort exhausted by a Bunsen's pump) to a small bulk. The solution was then divided into two parts, continuing the evaporation of the one to dryness at 100° C., weighing the residue as soon as it ceased to lose moisture, incinerating, and weighing the ash left; while the other was separately evaporated to dryness, exhausted with dilute alcohol (which took up a little glucose), and the residue dried at 100° C. and weighed; this being burned and the weight of ash plus the previously determined weight of albuminoid matter deducted, the quantity of gum was found by difference. In the dilute alcoholic solution glucose was determined by Fehling's copper solution. The pectous material was dissolved out from what water had left by repeated boiling with a dilute (1¼ per cent) solution of sodium hydrate, and precipitated by dilute sulphuric acid and alcohol, but it was found to be almost impossible to wash the slimy precipitate, and it could not have been relied upon as unaltered in weight from the original insoluble pectous material, so that this was estimated by difference. The cellulose left undissolved by the sodium hydrate was treated with very dilute sulphuric acid (in the cold and for a short time only), then thoroughly washed with water, thrown on a weighed filter, dried at 100° C., and weighed; after burning the weight of the ash was deducted. The results were:—

Glucose	0·87	Org. matter—	
Gum (with a trace of acid)	2·98	Sol. in water	4·63
Albuminoid matter	0·78		
Pectose	77·27	Org. matter—	
Cellulose	3·76	Insol. in water	81·03
Mineral matter, sol. in water	0·08		
,, insol. in water	3·56	Ash	3·64
Water	10·70	Water	10·70
	100·00		100·00

These figures, especially if taken in connection with Mr. R. T. Brown's results, are strongly suggestive of the correctness of the opinion of Messrs. Hanbury and Currey as to the general nature of the substance, viz., that it represents woody fibre altered by the interpenetration of a fungus mycelium. In the specimen analysed by the Chemist of the Agricultural Department the alteration seems to have been incomplete, leaving a good deal of unchanged cellulose; in the case now under notice the cellulose has nearly disappeared. The very small amount of nitrogen renders the notion of the whole mass being simply an independent and developed fungus very unlikely.

Mr. Keller also made an analysis of the ash, to obtain which about 100 grms. of the substance was incinerated at a very low temperature in porcelain crucibles placed each within another of sheet iron serving as a hot-air bath. The ash was tolerably free from remaining charcoal. Chlorine, carbon dioxide, and silica were determined from the whole amount used; and after dividing the solution into two portions, sulphuric oxide and the alkalies were obtained from the one, and phosphoric oxide, ferric oxide, lime, and magnesia from the other. The analysis afforded:—

Crude Ash.		*Pure Ash.* (Deducting Sand, Charcoal, and Carbon Dioxide.)	
K_2O	2·062	K_2O	4·675
Na_2O	0·967	Na_2O	2·192
CaO	2·280	CaO	5·169
MgO	5·017	MgO	11·375
Fe_2O_3	5·208	Fe_2O_3	11·808
P_2O_5	8·725	P_2O_5	19·781
SO_3	0·700	SO_3	1·587
Cl	0·724	Cl	1·642
SiO_2	18·424	SiO_2	41·771
CO_2	2·813		100·000
Charcoal	2·209		
Sand	50·546		
	99·675	Deduct O equiv. to Cl	0·370
Deduct O equiv. to Cl	0·163		99·630
	99·512		

The large amount of sand is not caused by want of care in removing the exterior portions of the mass. With a lens sparkling little siliceous grains can be detected on a perfectly clean cut surface of the interior. This again accords with the idea of a fungoid growth pushing its way in a sandy soil into disintegrating woody tissue, and cannot at all be conceived of as a result of simple independent vegetable growth. Part of the large percentage of silica found to be soluble, and perhaps of the iron also, may very likely be also mechanically derived from the soil, but how much we have no means of determining.

(To be continued.)

South African International Exhibition, 1877.—An International Exhibition will be held in Cape Town in 1877, in a building to be erected for the purpose, by consent of the Colonial Government. It will include manufactures of all kinds. The date fixed for the opening is February 15, and everything intended for the Exhibition must be shipped from London not later than during the first week in December, 1876. Intending exhibitors should communicate immediately with Mr. Edmund Johnson, Commissaire Delégué, at the European Central Offices of the Exhibition, 3, Castle Street, Holborn, London. The Exhibition will be arranged in the following classes:—Class 1.—Alimentation. Class 2.—Chemicals, perfumery, medicines, and surgical appliances. Class 3.—Furniture. Class 4.—Fabrics, clothing, watches, jewellery, ornaments, precious stones. Class 5.—Means of transport, travelling equipments, harness, saddlery, &c. Class 6.—Hardware, edge tools, cutlery, metal work of all kinds. Class 7.—Machinery, materials, and construction. Class 8.—Agricultural, &c. Class 9.—Science and Education. Class 10.—Miscellaneous.

occasionally eaten by the negroes of the Southern States, but the substance can by no means be said to be common, or commonly used as an article of food. In the analysis there is obviously a little error of statement in reporting elementary nitrogen and accounting for all that remains of 100 per cent in non-nitrogenous material.

THE HYGIENIC CONGRESS AT BRUSSELS.

The inauguration meeting of the *Congrès International d'Hygiène et de Sauvetage* took place at the Palais des Académies on the 27th ult., His Majesty the King of the Belgians being present. Lieut.-General Renard welcomed the Foreign Members of the Congress. M. Vervoot then delivered his Inaugural Address.

The Congress was divided into three sections, viz.—Hygiene, Saving of Life, Social Economy. The English Committee was constituted as follows:—

President.—Capt. Douglas Galton, C.B., F.R.S.

Hygiene.—Presidents, Mr. Edwin Chadwick, C.B., and Dr. Richardson, F.R.S., &c; Vice-Presidents, Dr. Hardwicke and Mr H. H. Collins; Secretaries, Mr. J. S. Phené and Mr. J. W. Pearse.

Saving of Life.—Presidents, Sir Henry Verney, Bart., and Mr. William Crookes, F.R.S., &c.; Vice-Presidents, Surgeon-Major Pater and Mr. G. M. Cooke; Secretary, Major Burgess.

Social Economy.—President, Mr. John Siltzer; Vice-President, Mr. Willis Bund; Secretary, Mr. John Russell, M.B.

The questions discussed in the first section included the following:—"What are the advantages of the distribution of population? Discuss the inconveniences which result of water, and what are the means for conveying it to the centres from taking water from the hydrographic basin. Statethe normal consumption per head of the inhabitants."

"Which is the most practicable system for ridding a town of its fœcal and putrescible matter and of its mud? Indicate the means (*a*) to purify sewage; (*b*) to utilise the drainage; (*c*) to prevent the contamination of water-courses by the refuse from factories; (*d*) to neutralise the noxious effects of dung-heaps in the proximity of dwellings, and to determine the circumstances which should regulate the choice of disinfectants and antiseptics."

In the second section the fifth question was—"What are the means of preventing explosions and flooding in mines, and of lessening their effects? Indicate the most secure means of lighting mines."

In the third section the first question was—"Determine the best arrangements, from a moral and hygienic point of view, for private dwelling-houses. Describe and examine the situation; the methods of heating, ventilation, and lighting; the means of supplying drinking-water and water for domestic uses; the systems of drainage."

A report on water-supply was read by M. Zimmer.

In the discussion which followed the report M. Gérardin contended that water was good if animals could live in it; that the higher the organisation of the animal life the purer would be the water. He did not consider the quantity of mineral salts had much influence, whilst the presence of organic matter was fatal to the infusoria. Water from different sources ought not to be mixed.

M. Vandenschriek believed that 200 litres per diem for each individual was an unnecessary quantity. Formerly, only 20 litres were allowed per head, and yet epidemics were not so numerous nor so fatal at that epoch as in the present day.

M. Bergé pointed out (1) that the town of Brussels had a water-supply dating from Joseph II. (2) That it had been proved that organic matters only are hurtful; that it was known that water charged with lime and with chloride of calcium killed the fish; that chemical analysis was necessary to determine the quality of water. (3) That it was not yet proved that the mixing of two good waters was injurious.

With regard to the distribution of water, Captain Douglas Galton was in favour of constant supply without cisterns in preference to the intermittent supply by cisterns.

The Count Torelli thought the determination of the quantity of water per head to each inhabitant very difficult, and varied naturally with the climate and the various conditions of the population.

M. Varrrentrap pronounced against all waters obtained from the towns themselves.

M. T'Serstevens insisted that water ought to be obtained from places thinly populated; where the soil is barren and the water superabundant.

M. Delue advocated the periodical inspection of cisterns.

The papers on the sewage question included one by Mr. Crookes, who described the A B C process of purifying and utilising sewage.

The programme of the conferences included a paper by M. L. Derote, Engineer of Bridges and Roads, on the conclusions of the report of the English Rivers Pollution Commissioners, so far as it concerns the oxygenation of contaminated waters; and on the purification of the Senne and the drainage works of the town of Brussels executed under his (M. Derote's) direction.

Full reports on each subject brought before the Congress are being prepared, and will shortly be printed.

The King of the Belgians has offered a prize of 5000 francs to that city, local authority, or private association which shall, by improvements in the dwellings of the working classes effect the greatest reduction of the death rate at the lowest cost. The prize will be awarded at the next International Hygienic Congress, which will probably be held in 1878.

NOTICES OF BOOKS.

Annual Report of T. P. Janes, Commissioner of Agriculture of the State of Georgia for the Year 1875.

This issue contains a judicious and temperate reply to the sweeping objections often raised against the analysis of soils as of little value in pointing out their properties. We should scarcely, however, give in our adhesion to the view that fluorine, small as are the proportions in which it occurs, is of no value.

A curious instance is given of a soil which appears to have been cropped continuously for about ninety years without ever having been manured. The subsoil was originally very rich in plant-food, but its valuable ingredients have been greatly reduced in quantity.

The cultivation of cotton is considered very unremunerative, and farmers are recommended to turn their attention, in preference, to wool-growing. There is, however, a difficulty in the way: 15 per cent of all the sheep in the State are destroyed by dogs, which in the United States are a greater nuisance than even in Europe.

The Report generally may be pronounced full of valuable matter, but by far the greater portion of this is of an economical rather than of a chemical character.

Sydney City and Suburban Sewage and Health Board: Seventh, Eighth, and Ninth Progress Report of the Board appointed on April 12th, 1875, to inquire into and report as to the best means of disposing of the Sewage of the City of Sydney and its Suburbs. Sydney: Thos. Richards.

Wherever mankind congregate in great numbers the sewage question, sooner or later, forces itself upon their attention. Believers in *laissez faire* may for a short time shut their eyes to polluted streams, and affect not to perceive the evil odours that hover around them. But in the long run erysipelas, typhoid fever, diarrhœa, and perhaps cholera, speak in a language which cannot be misunderstood, and action is taken, but frequently when too late. Rising communities, whether in the British colonies or in the United States, cannot too early set about combatting the inevitable evil. The longer the needful measures are delayed, the costlier and the less efficient they will prove. Australia has hitherto enjoyed a remarkable immunity from zymotic diseases, but if fever is once introduced

its complete expulsion may not prove easy. The Sydney authorities do not seem favourably disposed towards irrigation. It must be admitted, on the one hand, that in so comparatively dry a climate as that of Australia this method of dealing with sewage seems more feasible, from an economical point of view, than under the cloudy and drizzling skies of England; but, on the other hand, the danger to health will undoubtedly rise with the average temperature. We scarcely understand the precipitation scheme recommended at Sydney. The material to be employed is the carbonaceous residue from certain shales employed in the manufacture of kerosene oil. We can readily see how this matter might form a useful filter-bed, or how it might be employed as an adjunct in a precipitation process; but we are not aware that it contains any principle capable of acting as a true precipitant.

*Practical Manual of Chemical Analysis and Research applied to the Arts and Manufactures.** By P. A. BOLLEY and E. KOPP. Second French Edition, revised and enlarged. Translated from the Fourth German Edition, by Dr. L. GAUTIER. Parts 3 and 4. Paris: F. Savy.

THIS Manual is more extensive in its scope than any similar work in the English language. With the exception of purely pharmaceutical products it embraces every class of substances which are likely to fall into the hands of the commercial analyst or the "works-chemist." But as the entire book does not greatly exceed one thousand pages, we need not be surprised if some bodies are disposed of rather briefly, whilst others are treated at a disproportionate length. Thus alcoholic liquids occupy nearly one hundred pages, whilst soils and manures—which in this country certainly occupy a much larger share of the attention of analytical chemists—take up merely forty-two. In treating of the determination of phosphoric acid in manures and phosphatic minerals, the authors declare their conviction that of all known methods the molybdic acid process alone is capable of a general application, and yields results really trustworthy. All the other methods described, gravimetric or volumetric, are inexact or very tedious, on account of the presence of iron or alumina. The authors decide, contrary to the view of Birnbaum and Chojnacki, that nitric acid cannot be safely used as a solvent in the analysis of mineral phosphates, as notable quantities of phosphoric acid remain undissolved in the residue. They recommend hydrochloric acid when the presence of iron in the solution can occasion no difficulty, as when the molybdic method is to be used. In other cases Graham's solvent—sulphuric acid diluted down to 5 per cent of the monohydrate—may be advantageously employed.

For determining "reverted" phosphoric acid in manures they prefer the indirect method—ascertaining the total phosphoric acid insoluble in water, and deducting from this quantity the phosphoric acid insoluble in citrate of ammonia.

In treating on aræometry the authors strongly recommend Twaddle's hydrometer, in preference to those of Baumé and Beck, so much employed upon the Continent, and which are as devoid of any rational foundation as is the English system of weights and measures.

In the examination of magenta for sugar—an occasional adulteration—it is recommended to withdraw the colouring matter from the solution by means of wool or silk, or to precipitate it with common salt. The sugar then remains in solution, and may be easily recognised, and, if needful, determined.

The directions for the examination of lac-dye are somewhat insufficient. For certain uses, as in dyeing stuffs which require to be hot-pressed, it is very important that lac-dye should contain a minimum of gum-lac, for the approximate estimation of which the authors give no instructions. In treating of cochineal and indigo no allusion is made to the specific gravity of the samples, the determination of which is an easy and rapid way of detecting mineral impurities, whether accidental or intentional. Light cochinealls and indigos may certainly be bad, but heavy ones cannot be good. Flavin appears to have been entirely overlooked, and the extracts of the dyewoods are spoken of merely in the solid state in which they are so often met with on the Continent, and not in the liquid form prevalent in England. The preparation of extracts, we may here observe, is one of the branches of manufacturing chemistry in which England is now not holding her own. Very considerable quantities both of French and American extracts are now used in Lancashire.

The tables showing the reactions of colouring-matters—natural, artificial, and when fixed upon textile fibres—are very complete. As regards the coal-tar colours, the authors have in many instances taken the useful precaution of giving the name of the manufacturer, often the only method of identifying the exact substance in question.

The least satisfactory portion of the work is the section on milk, which is altogether out of date, and in which much space is devoted to those deplorable instruments the lactometer and the creamometer.

The book will form a useful addition to the library of reference of the analytical chemist.

* "Manuel Pratique d'Essais et de Recherches Chimiques appliqués aux Arts et a l'Industrie."

CORRESPONDENCE.

ROSE COLOUR OBSERVED IN THE MANUFACTURE OF CHLORATE OF POTASH.

To the Editor of the Chemical News.

SIR,—The following facts may throw some light upon the origin of the "rose" or red-violet colour observed in the course of manufacture of chlorate of potash, as noticed in Dr. Hofmann's "Report" &c. (CHEM. NEWS, vol. xxxiv., p. 139). Nearly all commercial samples of chloride of lime give, when boiled with distilled water, a splendid violet-red solution; on filtering through paper the colour disappears, and the paper is stained brown: if it be removed from the funnel, washed from adhering chloride of lime, and moistened with pure strong hydrochloric acid, the stain disappears, and a yellow solution is formed, which gives the characteristic iron-reactions with ferrocyanide and sulphocyanide of potassium. The purple solution may be obtained clear by subsidence, and may then be drawn off with a pipette; it may be evaporated nearly to dryness on the water-bath without decomposition, but on applying a somewhat stronger heat, to drive off the last traces of moisture, the coloured compound is decomposed, and the mass acquires a brown tinge.

If alcohol be added to the clear coloured solution a blue shade is first developed, and afterwards the colour gradually fades into a faint brown.

To determine the question of the presence of manganese, one drop of the coloured solution was placed on white filtering-paper, which was then dried on the water-bath; a brown stain appeared where the liquid had been: this was cut out, and divided into two parts; one of them was moistened with hydrochloric acid, and drops of ferrocyanide and sulphocyanide of potassium placed on opposite sides of the moistened portion; strong iron reactions were obtained in each case.

The other portion of the stained paper was incinerated and fused on platinum-foil with a little carbonate of soda; no trace of the manganese reaction could be observed with this most delicate test.

It is evident, therefore, that in the case in question the colour of the solution of chloride of lime is due to iron, not to manganese, and it would seem most probable that

the coloured compound is a lime-salt of ferric acid: this would account for the appearance of the colour where Deacon's process for the preparation of chlorine is used, since traces of iron could hardly be excluded from any process of chlorine manufacture.

It is to be noted that no colour is produced where the "chloride" is exhausted with *cold* water; a temperature at or near the boiling-point is necessary to the appearance of the phenomenon.—I am, &c.,

THOS. P. BLUNT, M.A. Oxon., F.C.S.

Tower Place, Shrewsbury,
October 3, 1876.

DETERMINATION OF GOLD IN PYRITES.

To the Editor of the Chemical News.

SIR,—In reply to "Assayer" on the above subject, I did not propose iron turnings myself, but simply gave the most convenient method for obtaining the gold from the mineral, as it had then been treated. And now, as "Assayer" will perceive, the deoxidising process still holds good in all cases.—I am, &c.,

LATENT.

October 9, 1876.

PROF. DITTMAR AND THE "ANALYST."

To the Edtior of the Chemical News.

SIR,—Referring to a letter which appeared in the CHEMICAL NEWS (vol. xxxiv., p. 151), signed by Mr. Wanklyn, we ask your permission to make a short statement as follows:—We beg to say that we are members of the Committee of Publication of the *Analyst*; that we consider we have devoted a fair amount of attention to our duties; that we have no wish to shirk our responsibility for anything that has appeared in the *Analyst*; and consequently we are in a position to deny—as we hereby emphatically do—Mr. Wanklyn's assertion that two other members of the Committee of Publication "alone are responsible for the contents of the paper."

Whatever may be Mr. Wanklyn's view of the duty of anyone holding office, we for ourselves can say that unless we felt ourselves both able and willing to perform our share of the duties of the Publication Committee of the *Analyst* we would certainly not allow our names to be published as members of that committee.—We are, &c.,

CHAS. HEISCH.
A. DUPRÉ.

October 9, 1876.

BLOWPIPE ANALYSIS OF THE NEW MINERAL HENWOODITE.

To the Editor of the Chemical News.

SIR,—Under the above heading (CHEM. NEWS, vol. xxxiv., p. 156) Major Ross gives an account of his examination, by his new methods, of Henwoodite. The following passage occurs in his article:—

"(6.) Heated another piece of (1), with pure oxide of lead, on a charcoal mortar on aluminium plate. Fused with great effervescence to a crystalline mass of plumbic phosphate, with minute balls of copper interspersed. (This new test for cupric phosphate is best seen with *Libethenite*: the copper disengaged seems beautifully pure)."

This is a very interesting and characteristic reaction, but it is most certainly not *new*, as Major Ross asserts it to be. On the contrary, it is very old, and very well known to everybody who has practised the use of the blowpipe to any extent. If Major Ross will obtain a copy of Plattner's book on the Blowpipe, he will find the test fully described (the copy now before me is the German edition of 1865), and learn that it was given first by Berzelius. It was taught to every student at Freiberg, and I have seen it used very frequently there and elsewhere. It is certainly *new* to use oxide of lead for the test, the usual method being to fuse the mineral with a piece of metallic lead. The use of *oxide* serves no good purpose, and has no object whatever; it only increases very unnecessarily the "great effervescence" of which Major Ross speaks.

It is quite correct of Major Ross to state that the test is best seen with *Libethenite*; and if he will look under that mineral in Dana's "Mineralogy" he will find the reaction fully described.—I am, &c.,

H. M. W.

HENWOODITE.

To the Editor of the Chemical News.

SIR,—Allow me to write a few lines in reply to Major Ross's remarks on my blowpipe experiments with Henwoodite. He says that by the methods I employed "the iron present is not detected at all." The reason I did not find any iron is simply this—there was probably none present. I took great care to use very pure fragments of the mineral, examining each one minutely with a lens before testing it; and my friend Mr. J. H. Collins informs me that when he tested some pure specimens with sulphocyanide of potassium, he was unable to detect the presence of iron. Major Ross admits that his specimens, even after his beginning to test them, were mixed with Göthite (? Limonite), and I cannot help surmising that the iron he detected was simply a mechanical impurity. Had there been much iron present I should not have obtained a blue bead with borax (cold). Besides, the precipitate with ammonia would have revealed its presence.

I cannot lay claim to the "great sagacity" with which Major Ross credits me for suspecting the presence of P_2O_5 in Henwoodite. The association of that mineral with Chalkosiderite, a hydrated phosphate of iron and copper, and its globular form, would naturally lead any mineralogist to test for phosphoric acid.

One word more:—Major Ross's "new test for cupric phosphate" seems to me to be merely a modification of Berzelius's good old method, which has been known for more than fifty years.* Berzelius used metallic lead, which is found in every complete blowpipe case, whilst Major Ross employs the oxide. The new method requires an additional, and it appears to me unnecessary, reagent.

In conclusion, let me assure you that I would not on any account undervalue Major Ross's labours; on the contrary, I congratulate him on having discovered many new and original tests in the too much neglected art of blowpipe analysis.—I am, &c.,

CLEMENT LE NEVE FOSTER.

Truro, October 16, 1876.

* Berzelius, "Anwendung des Löthrohrs," p. 164. Nürnberg, 1821.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances, de l'Academie des Sciences. No. 13, September 25, 1876.

Probable Consequences of the Mechanical Theory of Heat.—M. Le Général Favé.—The substance which fills space, and which we call ether, without knowing whether it is simple or multiple, transmits the solar heat to the planets. This heat is a vibratory movement which the ether communicates to ponderable matter, and which has a speed of translation so considerable that we may ask if the heat coming from the sun does not exert a re-

pulsive force upon each planet. Transparent bodies are traversed by radiant heat in a greater or less degree. That is, the vibratory movements of the ether intercommunicate in the whole interior of the transparent body without being transmitted, at least directly to the ponderable matter. Thus, transparent bodies are constituted with ether interposed in their interstices. It is known that a body which has passed from the solid to the liquid state, or from the liquid to the gaseous, has absorbed latent heat, and yet the molecules doubtless have not changed their vibratory speed when the solid, liquid, or gas have been brought to the same temperature. What, then, is the latent heat, that is to say, the movement insensible to the indications of the thermometer? We believe that everything may be explained; that the liquid contains, to a larger degree than the solid, interposed ether, which vibrates in unison with the ponderable matter. On this hypothesis, the gas would contain yet more constitutive ether than the liquid. The transparence of liquids, and the facility with which gases give passage to radiant heat, are facts favourable to this explanation.

Photo-micrographic Researches on the Effects of the Reduction of Salts of Silver in Photographic Proofs.—M. J. Girard.—On examining under a strong magnifying power a negative proof developed indistinctly with sulphate of iron or pyrogallic acid, we remark almost invariably in the light portions not acted upon, crystals uniformly disseminated, scarcely 1-100 of a m.m. in size. These crystals of reduced iodide of silver, sometimes very abundant, are the cause of frequent failures, as they form a cloud impervious to light.

New Process for the Extraction of Gallium.—M. Lecoq de Boisbaudran.—The ore, according to its nature, is dissolved in aqua regia, hydrochloric or sulphuric acid. The cold liquid is treated with plates of zinc, and filtered, when the escape of hydrogen is still considerable. The liquid is then heated with a large excess of zinc. The gelatinous deposit is washed, and redissolved in hydrochloric acid. The new liquid is heated with an excess of zinc, and a second gelatinous precipitate is obtained. Into the hydrochloric solution of this second precipitate formed by zinc a current of sulphuretted hydrogen is passed, the liquid is filtered, the excess of sulphuretted hydrogen driven off, and it is fractionated with carbonate of soda, ceasing when the ray $Ga\alpha$ 417·0 ceases to be visible with the hydrochloric solution of the precipitate. The oxides or sub-salts are taken up with sulphuric acid; the solution is carefully evaporated until white sulphuric acid vapours are no longer, or but slightly, given off. It is let cool, and stirred with water, which dissolves the mass after the lapse of a time varying from some hours to a couple of days. The solution of the sulphate almost neutral is diluted with much water, and raised to a boil. The sub-salt of gallium is separated by filtration whilst hot. This basic salt is dissolved in a little sulphuric acid, and the liquid is mixed with a slight excess of caustic potassa, so as not (?) to dissolve the gallium, but to leave the iron. It is filtered, and the oxide of gallium is precipitated by a prolonged current of carbonic acid. This oxide is re-dissolved in a minimum of sulphuric acid, a slight excess of acetate of ammonia, feebly acid, is added, and it is then treated with sulphuretted hydrogen. Under these conditions the gallium is not precipitated. The acetic liquid is filtered, diluted with water, and raised to a boil. The bulk of the gallium is precipitated and filtered whilst hot. The mother-liquor, concentrated, and boiled with aqua regia in order to destroy ammoniacal salts, is added to the other gallium residues. The precipitate formed on heating the acetic liquid is re-dissolved in sulphuric acid, a slight excess of caustic potassa is added, and it is then filtered. The potassic solution is electrolysed. The gallium is easily detached from the sheet of platinum on pressing it between the fingers under warm water. The metal is then immersed for about half an hour in nitric acid at about 60° or 70°, quite free from chlorine, and diluted with an equal volume of water. After washing it may be regarded as pure.

Moniteur Scientifique, du Dr. Quesneville, September, 1876.

Anthraflavic and Iso-anthraflavic Acids.—MM. E. Schunck and H. Rœmer.—These authors have announced in an earlier memoir the discovery of an acid isomeric with the anthraflavic, to which they have given the name of isoanthraflavic acid, and which is prepared as follows:—The crude material prepared by Mr. Perkin is obtained on precipitating with hydrochloric acid a solution derived from the treatment of crude alizarin with lime-water. It is first separated from anthraquinon by dissolving the precipitate in dilute soda-lye: the filtrate yields, on the addition of hydrochloric acid, a yellow precipitate, which is partly dissolved in cold baryta-water. The blood-red solution is precipitated by acids in green flocks, turning red. This precipitate, if repeatedly crystallised from alcohol, gives a substance which forms yellow needles, and which, if dried at 150°, yields on analysis the following results:—

	Found.	Calculated for $C_{14}H_8O_4$.
C	69·79	70·00
H	3·62	3·33

Isoanthraflavic acid crystallises with water; a portion evaporates on desiccation over sulphuric acid, but the crystals preserve their lustre unless heated to 120°. The authors have also analysed the barium salt which corresponds to the formula $C_{14}H_6BaO_4$.

Anthraflavic Acid.—The portion insoluble in cold baryta-water (see above) is composed of anthraflavic acid. The barium salt of this acid closely resembles the corresponding salt of isoanthraflavic acid, but it is insoluble. It crystallises with two molecules of water, and is gradually decomposed on exposure to the air.

Properties of Isoanthraflavic and Anthraflavic Acids,

Isoanthraflavic Acid.	Anthraflavic Acid.
Crystallises from aqueous alcohol with crystalline water.	Crystallises without water.
Melting-point above 330°.	Ditto.
Less soluble in glacial acetic acid than in alcohol.	Ditto.
Almost insoluble in benzol, chloroform, and ether.	Ditto.
Soluble in hot concentrated sulphuric acid with a deep red.	Soluble in concentrated sulphuric acid with a yellow.
Easily soluble in cold baryta-water.	Insoluble in cold baryta-water.
Easily soluble in lime-water.	Soluble with difficulty in cold lime-water, and less soluble at a boil.
Carbonic acid throws down anthraflavic acid from the aqueous solution of the barium salt, but the salt is re-formed on ebullition.	Ditto.
Soluble in alcoholic lead acetate.	Ditto.
The solutions in alkalies and alkaline earths are of an intense red.	The solutions in alkalies and alkaline earths are more or less tinged with reddish yellow.
Sublimes in brilliant yellow needles and leaflets.	Ditto.
Is not fixed by mordants.	Ditto.

The authors have examined the tetrabromated isoanthraflavic acid, the corresponding anthraflavic compound, and the diacetylic, diethylic, and dimethylic derivatives of the two acids.—*Berichte der Deutschen Chemischen Gesellschaft zu Berlin.*

Easy Method of Preparing Condensed Hydrocarbides.—Watson Smith.—The author passes through an ignited tube vapours of naphthalin mixed with trichloride of antimony. Isodinaphthyl is obtained.

Addition-Products of Aldehyd.—M. R. Schiff.—This paper consists chiefly of hypothetical formulæ.

On Aniline-Black.—M. R. Nietzki.—The aniline used as material was prepared from crystallised benzol; it had a constant boiling-point (182°), and yielded no magenta when treated with chloride of mercury. The aniline-black was prepared by Muller's method:—A mixture of 20 grms. chlorate of potassa was heated with 30 grms. sulphate of copper, 16 grms. sal ammoniac, and 40 grms. hydrochlorate of aniline dissolved in 500 c.c. of water. Vapours escape, having the odour of chloropicrin, and the solution is converted into a greenish black paste. The vapours are not perceived when a salt of aniline is employed which has been purified by re-crystallisation, whence the author concludes that their origin is due to the presence of traces of nitrobenzol. The product of the reaction is boiled with dilute hydrochloric acid, dried, ground up, and treated with benzol, ether, petroleum, and alcohol; or it is preferably boiled with acidulated alcohol, which dissolves a large quantity of brown matter. There remains a dark green powder, which M. Reineck considers as the hydrochlorate of a base which he proposes to name nigranilin. Aniline-black dissolves in sulphuric acid with a violet colour, and is precipitated from this solution on the addition of water as a sulphate. Coquillion obtained aniline-black by the electrolysis of a salt of aniline, and R. Meyer by the action of permanganate of potassa. The author attempted to purify aniline-black by solution in concentrated sulphuric acid, but this method cannot be employed because the solution filters very slowly, and the product thus treated leaves on combustion a large quantity of ash. It is preferable to dissolve aniline-black in aniline, and then neutralise with hydrochloric acid, which throws down the colouring matter, but the yield is very trifling, as a large proportion remains in solution. The author concludes that aniline-black is the mono-acid hydrochlorate of a triamin, having the formula $C_{18}H_{15}N_3HCl$, and is composed of—

C	69·79
H	5·17
N	13·57
Cl	11·47

Constitution of Naphthalin.—M. F. Wreden.—This paper consists of hypothetical formulæ.

Titration and Assay of Salts of Soda.—M. A. Favre.

MISCELLANEOUS.

County Analyst for Cheshire.—On Monday last Mr. J. Carter Bell, Public Analyst for Salford, was elected by a large majority to be the County Analyst for Cheshire.

The Monthly Reports of the Department of Agriculture.—The reports for May and June, 1876, issued from the Government Printing Office, Washington, contain a notice of the Centennial Exhibits of the Department of Agriculture. One feature of these, though nowise chemical in its nature, claims brief notice on account of its importance and novelty of arrangement. It is a collection of destructive insects, arranged, not according to their scientific classification, but according to the fruits, farm produce, &c., which they injure or destroy. "Thus under the head of 'potato,' the various insects known to injure the plant in root, stalk, leaf, or fruit are shown from egg to perfect insect, when practicable, accompanied with samples illustrating the mode of injury. Other cases illustrate the insect pests of man and cattle, the foes of the household, and the larder, whilst others show the principal insects beneficial to mankind either by destroying noxious species or as scavengers." In close proximity are shown the birds that are either injurious or beneficial. "The character of the birds is indicated in each case by the mark upon the perch or label; white indicating purely insectivorous birds, black those of wholly pernicious habits, and both colours the relative proportion of each element in these possessing more or less marked proclivities for a mixed diet. A little box in close juxtaposition to each affords the means of judging of these characteristics by an exhibit of the dried contents of a full stomach." Would not such a collection form a very useful feature in the economic museums of our country? The microscopic exhibits comprise highly magnified views of the fungi commonly known as "molds," so destructive to vegetation. The chemical department embraces an extensive assortment of rocks, with samples of the soils formed by their disintegration and decomposition of marls, mineral manures, such as phosphatic rocks and limestones, and of vegetable, animal, and compound manures. Another grand series shows useful agricultural and horticultural products and their preparations. Such collections are evidently of great permanent value and it is to be hoped will not be dispersed when the Centennial Exhibition is at an end. The Report for July contains notices of the steps taken in Spain for the destruction of locusts and for promoting the growth of forests. Locusts, it is found, like most other insect-plagues, are always most plentiful in dry, open, treeless wastes, land of the very class in which Spain is now so rich. There is an interesting article on the cultivation of coffee in Mexico and also in Brazil, and a variety of agricultural notices from many parts of the world. The Report for August and September is chiefly filled up with very complete returns of the condition of the principal crops throughout the United States. The agricultural interests of America are judiciously watched over by the Government, which, without any attempt at vexatious interference, collects and distributes valuable information, and what is equally important, puts it in a clearly intelligible form. It would certainly be beneficial to our agriculturists if monthly reports like the one before us were circulated amongst them. Forest-planting, strange as it may sound to those who conceive of America as it was a hundred years ago, is strongly and wisely advocated. The usual complaints about insect pests are not wanting. This evil is a necessary result of the system of gigantic fields without hedge-rows and trees, and consequently devoid of shelter for the small birds. Some interesting climatological facts deserve attention. Thus in Georgia the apples were mostly destroyed by a frost in April, although the district corresponds in latitude to the delta of the Nile.

NOTES AND QUERIES.

*** Our Notes and Queries column was opened for the purpose of giving and obtaining information likely to be of use to our readers generally. We cannot undertake to let this column be the means of transmitting merely private information, or such trade notices as should legitimately come in the advertising columns.

Animal Charcoal.—Will any of your readers kindly refer me to a good work on the technical analysis of animal charcoal.—T. W. I.

Separation of Arsenic and Copper.—In answer to query concerning separation of arsenic and copper, I may say that I have experienced the same difficulty myself, and it is, I think, a very likely one for persons who have not practised long. I think it is from a fear of having too much alkaline sulphide in the solution that it arises. I may say too that I have found a little of either caustic soda or potash in the ammonium or other sulphide to be beneficial when copper and arsenic only have to be separated.—Wm. Ellstone.

Preservation of Iron from Action of Salt.—Can you give me the name and address of the society or English scientific academy which has offered a prize to the inventor of an agent which will actually preserve iron from the oxidising action of the saline matter in the air of the Antilles, and especially from the action of salt-water, and which will at the same time prevent the aggregation of molluscs and shell-fish on the iron, wood, or stone which are plunged into such waters.—A.

THE CHEMICAL NEWS.

Vol. XXXIV. No. 883.

ON REPULSION RESULTING FROM RADIATION.—PART II.*

By WILLIAM CROOKES, F.R.S., &c.

(Continued from p. 163.)

87. With a large bulb, very well exhausted and containing a suspended bar of pith, a somewhat striking effect is produced when a lighted candle or other radiant source is brought about 2 inches from the globe. The pith bar commences to oscillate to and fro, the swing gradually increasing in amplitude until the dead centre is passed over, and then several complete revolutions are made. The torsion of the suspending fibre now offers resistance to the revolutions, and the index commences to turn in the opposite direction. This movement is kept up with great energy and regularity as long as the candle burns—producing, in fact, perpetual motion, provided only the radiation falling on the pith be perpetual.† If the candle is brought closer to the bulb, the rotation of the pith becomes more rapid; if it is moved further away the pith ceases to pass the dead centre, and at a still further distance the index sets equatorially. The explanation of the different movements of the pith index according to the distance the radiant body is off, is not difficult on the supposition that the movement is due to the direct impact of waves on the suspended body.

88. It is not at first sight obvious how ice, or a cold substance, can produce the opposite effect to heat, cold being simply negative heat (33). The law of exchanges, however, explains this perfectly. The pith index and the whole of the surrounding bodies are incessantly exchanging heat-rays; and under ordinary circumstances the income and expenditure of heat are in equilibrium. A piece of ice brought near one end of the index cuts off the influx of heat to it from that side, and therefore allows an excess of heat to fall upon it from the opposite side. Attraction by a cold body is therefore seen to be only repulsion by the radiation from the opposite side of the room.

Bearing the law of exchanges in mind, several apparent anomalies in the movements of these indices are cleared up; and it is also easy to foresee what the movement of a body will be when free to move in space under the influence of varying amounts of radiation.

The heat which all bodies radiate into space can have no influence in moving them, except there be something in the nature of a *recoil* in the act of emitting radiation. And even should there be such a recoil, if the body radiates heat equally all round, the recoil will be uniform, and will not move the body in one direction more than in another. I need therefore only consider the effect of the radiation *received* by a body. Here also the influx of radiation to a body free to move in space of a uniform temperature may be considered to be equal, and it will acquire the temperature of space without moving in any direction.

89. The case is, however, different if two bodies, each free to move, are near each other in space, and if they differ in temperature either from each other or from the limiting walls of the space. I will give here four typical cases, with experiments sufficient to prove the reasoning to be correct.

Case I. Two hot bodies, A and B, in space of a lower temperature than themselves. The body A receives heat uniformly from space, except where the body B intervenes; and on this side A receives more heat, as B is hotter than the space behind it; A will therefore move from B. In the same manner it can be shown that B will move from A. The result will therefore be *mutual repulsion*.

Fig. 2. Case I.

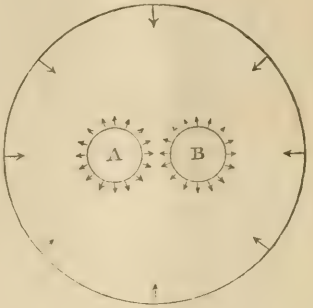
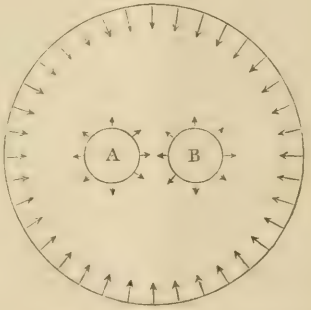


Fig. 2. Case II.



Case II. Two cold bodies, A and B, in space of a higher temperature than themselves. A will receive much heat from space, except where B cuts it off, and on that side it will only receive slight radiation from B. A will therefore be driven towards B. In the same manner it can be shown that B will be driven towards A; and the result will therefore be an *apparent mutual attraction*.

Case III. Two bodies, A hot and B cold, in cold space. The body A receives heat uniformly from all sides, even from that opposite B (B being of the same temperature as space). A will therefore not move. B receives heat uniformly from all sides, except from that opposite A, on which side the influx of heat is more intense. The result will therefore be that A *remains stationary whilst* B *is repelled*.

Case IV. Two bodies, A hot and B cold, in hot space. The body A receives heat uniformly from all sides, except from that opposite B. Here the heat is less intense. A is therefore driven towards B by the extra influx of heat on the other side of A. B receives strong influx of heat from all sides, and just as much from the side opposite A as from any other. B will therefore not move. The result will be that A *will be apparently attracted towards* B, *whilst* B *will remain stationary*.

The force with which the bodies A and B in these four

* A Paper communicated to the Royal Society, March 30, 1875. From the *Philosophical Transactions of the Royal Society of London*, vol. clxv., pt. 2.

† This experiment was exhibited for the first time at the Royal Society's Soirée, April 22, 1874.

cases will be repelled, or apparently attracted, will vary with their distance from each other, being stronger when they are close and weaker when they are far apart. The

Fig. 2. Case III.

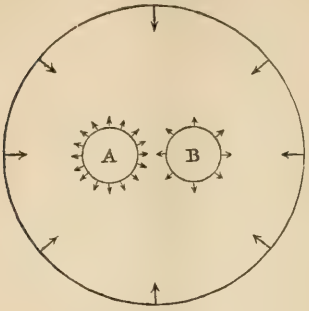
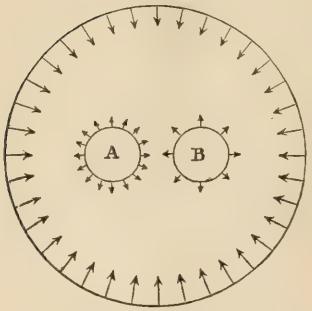


Fig. 2. Case IV.



diminution will not, however, follow the usual law of inverse squares, but a more complicated law.

To be continued.)

ON THE ACTION OF DIFFERENT FATTY OILS UPON METALLIC COPPER.*

By WILLIAM THOMSON, F.R.S.E., F.C.S.

With the view to study the actions of different fatty oils upon copper I made two series of experiments. In the first, which was commenced on the 1st October, 1875, I took twenty-six different samples and measured 150 grs. of each into bottles; into each bottle was then placed a piece of copper foil, 1 inch long by ½ inch broad, so as to lie flat at the bottom of the oil. After a few days it was observed that some of the samples had acted on the pieces of copper, some had thrown on to the metallic surface a slight greenish incrustation, some had produced a dark coloured incrustation, and the remainder produced no effect on the bright metallic surface of the copper.

No special examination of either the metallic copper or the oils was made till they had remained in contact for ten months at the ordinary temperatures of the atmosphere.

The second series was commenced about one month later than the first, and differs from the first somewhat in the detail of its arrangement. Eighteen different samples were employed, each oil representing in both series a distinct and different sample, although in some cases two or more of the same kind of oil were employed, and I am indebted to the kindness of Mr. Wollaston, of Manchester, for the greater number of the samples used in both series and for the care which he exercised in obtaining samples which could be relied upon as being free from adulteration.

In this second series 300 grs. of each sample were placed in bottles, and a slip of well-cleaned metallic copper, 3½ inches long by ¼ inch broad, put into each so that only one half of the slips was immersed in the oil, whilst the other half was exposed to the air.

The following is a list of the different samples used:—

In First Series.	In Second Series.
Vegetable Oils.	*Vegetable Oils.*
1. Mesina olive oil.	1. Olive oil.
2. Olive oil.	2. ,,
3. Rape oil.	3. Pale rape oil.
4. Refined rape oil.	4. Brown rape oil.
5. Cotton seed oil.	5. Cotton seed oil.
6. Pale cotton seed oil.	6. Raw linseed oil.
7. Cotton seed oil.	7. Palm nut oil.
8. Linseed oil.	8. Ground nut oil.
9. Almond oil.	9. Castor oil.
10. Palm oil.	*Animal Oils.*
Animal Oils.	10. Pure lard oil.
11. Lard oil.	11. Common tallow oil.
12. Tallow oil.	12. American tallow oil.
13. Foreign neatsfoot oil.	13. English neatsfoot oil.
14. Neatsfoot oil.	14. North American neatsfoot oil.
Fish Oils.	*Fish Oils.*
15. Sperm oil.	15. American sperm oil.
16. Pale seal oil.	16. Whale oil.
17. Seal oil.	17. Pure seal oil.
18. Common seal oil.	*Mineral Oil.*
19. Whale oil.	18. Lubricating mineral oil.
20. Shark oil.	
21. Cod oil.	
22. Newfoundland cod oil.	
23. Raw cod oil.	
24. East India fish oil.	
Mineral Oil.	
25. Heavy mineral oil.	
26. ,, ,,	

All these samples of oil, together with the slips of metallic copper left in contact with them, were examined on the 9th of August, 1876, in the following manner:—

First.—Each slip of copper was carefully examined and its appearance noted.

Second.—The appearance of each oil was observed and noted.

Third.—Ten grains of each sample were measured off by a pipette and placed in a small test-glass, and 5 grs. of a moderately strong solution of ferrocyanide of potassium added, and the oil and solution thoroughly mixed by stirring them together for some time and then leaving them for about a day. This method I found to give the most satisfactory result for testing the relative proportions of copper which had been dissolved by the oils; the characteristic brownish red precipitate of ferrocyanide of copper being thrown down admitted of very accurate comparison.

Fourth.—Fifteen grains of each oil were taken by means of a pipette, and each placed in a small stoppered test-tube; 15 grs. of distilled water were then added and each tube shaken violently. The tubes were then suspended in water and heated to about 200° F. and shaken violently two more times at intervals of one hour each, and allowed to remain in contact with the hot water at 200° F. for six hours; the source of heat was then removed and the oils allowed to remain over the night to allow the water to separate from the oils more completely.

* Read before the British Association, Glasgow Meeting (Section B.).

In the morning the water was drawn off from the tubes by a pipette having a long fine point, and each transferred to a small test-glass. A drop of each solution was then taken out by a clean glass stirring rod and spread across pieces of blue litmus paper in a series of lines side by side with each other, the intensity of redness thus produced by the acids dissolved by the water compared, and the results noted.

Fifth.—Five grains of a moderately strong solution of ferrocyanide of potassium were then added to each water solution above mentioned, the mixture stirred, and left for four hours, when the amounts of the precipitates of ferrocyanide of copper were observed comparatively and the results noted. The results of these observations I have arranged in tabular form.

(To be continued.)

PYROLOGY, OR ANALYSIS AND SYNTHESIS BY THE BLOWPIPE.

By MAJOR ROSS, late R.A.

(Continued from vol. xxxiii., p. 3.)

(11.) THE fact may have been noticed, with regard to the Scientific Loan Exhibition at South Kensington, that three-fourths of the apparatus, &c., there displayed are *foreign*, and that a great part of the remaining fourth, although the property of English "Manufacturers," has in reality been produced in Paris, Berlin, or some other French or German town, while Sir W. Thomson, Sir. J. Hawkshaw, and others less celebrated, who have lately arrived from America, are unanimous in the opinion that, unless we are careful, the Americans will shortly pass us in those *manufactures* of which we have hitherto been most proud. In short, look on the matter as we may, deny the fact as we will, it seems doubtful if *nationally* England occupies more than the third place in scientific Europe.

(12.) The reason of this appears that, like everything else, scientific knowledge is made a mere matter of barter in England. Only rich men can here afford to do anything original in the way of physical or chemical experimentation.

(13.) Here then, briefly, is what the blowpipe will do for a student who takes it up with due appreciation:—(*a*) The necessary apparatus is, or ought to be, *cheapest of the cheap*, even the balance required for quantitative analysis being the smallest and cheapest kind made. (*b*) Accurate observations can be made so *rapidly* that even the public teacher in chemistry and physics can thus most beneficially employ his little leisure. (*c*) The field of observation is almost entirely unoccupied, so that the disciple, unencumbered by the terrific terminology of chemistry, may after a short time bring contributions to physical science really worthy of her acceptance; while geology and mineralogy will after a time acquire a new zest from such examinations. (*d*) If our manufacturers were only equal to the Germans or French, a traveller's apparatus might be made for a few shillings, in a leather case, which would roll up and go into the breast pocket of a coat, enabling the investigator to start at a moment's notice for the country or abroad. I shall try to induce Messrs. Griffin to make up such a case of blowpipe necessaries, and to sell it *as cheaply as possible*.

(14.) All sciences are so linked together that a correlation can be shown to exist even between two of the most apparently widely separated. Few, for instance, would suspect that the political economist could derive any benefit from the study of blowpipe analysis, and yet the case of the tumble-down barracks and public buildings all over Northern Indian, publicly stated, without denial, to have cost the Government £40,000,000, between the years 1861-75, is one in point; but the account of this must be reserved for the next paper.

ON ANTHRACEN TESTING.

By DR. FREDERICK VERSMANN.

IN a paper "On Anthracen and Alizarin," read before the Society of Arts in March, 1874, I ventured to express my opinion that the quinon test was not trustworthy, because it did not represent true anthracen convertible into alizarin, and also because the stipulated correction, equal to 1 per cent, made the whole process illusory.

At that time I stood alone in my opinion, but it is now perfectly well known among manufacturers and buyers of anthracen that the quinon test does not always indicate the exact and true value of the merchandise; and even Messrs. Meister, Lucius, and Brüning, who first proposed the test, now acknowledge its inaccuracy by issuing in last week's CHEMICAL NEWS (vol. xxxiv., p. 167) a new and improved method.

This new test differs from the previous one merely by an increase of the oxidising agent—chromic acid and its solvent acetic acid and water—and by the treatment of the quinon with fuming sulphuric acid instead of with potassium permanganate, and subsequent volatilisation of the remaining quinon.

The publication of this "*new and improved method*" induces me to collect the results of prolonged investigations on the subject, which, although not yet brought to a final conclusion, may tend to throw some light on the nature of the products obtained, and I am the more inclined now to publish my experience, because more than six months ago I tried the sulphuric acid myself, but found it neither satisfactory nor practical. In fact it was exactly the failure with sulphuric acid which induced me to follow up the subject in a different direction, and, as I believe, with more satisfactory results.

After boiling a sample of anthracen with chromic acid solution, and allowing the mixture to stand for hours, long, well-defined crystals separate, and on adding water a further separation takes place, not in the form of crystals, but of an amorphous powder. The product collected on the filter is always a mixture of crystals and powder, part of the last of which is again removed by potassium permanganate and potassium hydrate.

This observation induced me to collect the crystals and powder separately, and to ascertain their nature by practical tests applicable for commercial analyses. As such I adopted, above all, the melting- and solidifying-points, and then the action of potassium permanganate and potassium hydrate.

The determination of the melting- and solidifying-point I look upon as most important and valuable, and I can only express my surprise that it has not been introduced long ago, especially as it formed so important a part in the alcohol and bisulphide test.

I have collected in the following table some results from a great many, which fairly represent commercial anthracen from the lowest to the highest percentage. The first column gives the percentage of quinon actually obtained, *i.e.*, without correction; the second and third columns give the crystals and powder separately; and the last column the number of drops of 5 per cent potassium permanganate solution required to leave a distinct colouration after prolonged boiling of each of the three products.

As to the operation itself, the first result was obtained by the usual test with appendix. In the separation of crystals and powder the solution was allowed to stand over night; the crystals were then collected on a small filter, and the solution allowed to run off to the last drop, before the crystals were washed with water, until the filter and filtrate were perfectly colourless. The filtrate was then diluted to 600 c.c., and after two hours' standing the powdery precipitate was also collected on a filter; both crystals and powder were then treated with potassium permanganate and potassium hydrate.

I have long adopted an increased addition of water, but for a different reason than the one now stated by Messrs.

Anthraquinon Test.

	Crystals and Powder Mixed.	Crystals.	Powder.	Drops of 5 p.c. Potassium Permanganate.
	283	278		
1.	11·4 275—279	6·6 272—275	4·8 not at 300	15 3 20
	280	278	274	
2.	11·9 274—277	9·4 274—276	2·7 264—269	10 3 12
	277	278	275	
3.	14·2 273—275	10·2 272—275	4·0 273—274	6 2 5
	278	279	270	
4.	14·2 270—274	9·2 273—276	5·3 272—271	10 4 16
	278	278	273	
5.	15·2 270—274	10·3 272—275	5·4 271—272	9 4 10
	276	278	280	
6.	15·2 274—275	10·2 274—276	4·6 270—275	8 3 10
	276	278		
7.	16·0 270—273	12·5 274—276	3·6 not at 300	25 3 28
	278	277	278	
8.	16·2 274—276	11·6 273—275	5·2 266—272	12 4 12
	270	277		
9.	17·8 266—268	9·8 273—275	7·7 not at 300	27 4 27
	279	277		
0.	18·2 271—275	14·2 275—276	3·9 not at 300	20 4 24
	278	277		
11.	20·2 274—276	16·3 273—275	3·7 not at 300	9 3 10
	277	277		
12.	20·6 273—275	17·8 275—276	2·6 not at 300	15 4 14
	277	281	276	
13.	22·0 273—275	18·3 273—277	4·0 266—271	16 5 15
	270	276	260	
14.	23·3 266—268	15·1 272—274	8·0 256—258	6 2 6
	278	278	278	
15.	23·8 274—276	19·9 276—277	3·6 270—274	8 2 7
	280	280	271	
16.	26·4 274—277	22·1 276—278	4·2 261—266	10 3 11
	277	278	270	
17.	27·0 273—275	20·8 274—276	6·1 260—265	12 2 14
	270	274	264	
.	30·2 268—269	24·9 274—274	5·3 256—260	8 3 10
	273	277	259	
19.	30·5 267—270	24·6 273—275	5·6 253—256	10 4 14
	278	278		
20.	34·8 268—273	30·0 276—277	4·6 not at 300	22 6 20
	280	280		
21.	36·5 274—277	30·6 274—277	5·7 not at 300	16 5 18
	280	281		
22.	37·2 274—277	33·1 277—279	4·0 not at 300	12 5 16
	271	275	262	
23.	39·9 267—269	34·0 273—274	5·8 258—260	8 2 8
	278	278	276	
24.	41·7 276—277	38·3 276—277	3·3 264—270	10 3 12
	278	276	270	
25.	45·2 270—274	41·1 274—275	4·0 266—267	9 3 10
	268	275	246	
26.	49·5 268—268	40·9 271—273	8·7 250—248	10 2 10
	280	280		
27.	52·5 272—276	47·9 274—277	4·7 not at 300	16 4 16
	279	280		
28.	56·3 275—277	53·9 274—277	2·6 not at 300	16 3 16
	280	275	250	
29.	60·0 270—275	55·4 273—274	4·2 240—245	12 2 14
	282	280	285	
30.	68·5 272—277	63·2 276—278	5·1 287—286	10 3 12

Meister, Lucius, and Brüning. I have always doubted the accuracy of adding 1 per cent of quinon, supposed to be retained in solution, and I have satisfied myself on that point by actual experiment. I have frequently evaporated the green solution to perfect dryness, and exhausted the dry powder with benzol and alcohol, but I have never succeeded in separating real quinon. The larger quantity of water merely separates the powder more completely, which no doubt accounts for the increased quantity of potassium permanganate used with the powder.

The conclusions drawn from this table, I may state as follows, viz.:—

1. The total of crystals and powder in all cases very nearly agrees with that of the mixture; no loss is incurred by the separation.
2. The melting- and solidifying-point of the mixture, *i.e.*, of the usual test, is mostly suspicious, in many cases a direct indication of undoubted impurity of the quinon.
3. The melting- and solidifying-points of the crystals alone are much more uniform; the product is pure quinon.
4. The powder in almost all cases is no quinon at all; in eleven cases out of thirty it does not melt at 300° C., but blackens and remains solid; in eleven other cases the mean of the two points is below 270° C., and in several of the other cases the melting- and solidifying-points were only partial or indistinct at the points indicated.
5. The effect of potassium permanganate is uniformly very trifling upon the crystals, very considerable upon the powder, and exactly the same is the case with potassium hydrate; while the mixture often imparts distinct colouration to the solution and becomes itself lighter in colour—from orange to pale straw-yellow—the crystals alone scarcely show any change, but the powder invariably gives a strong colour to the solution.
6. While the crystals may safely be taken as pure quinon, the question arises whether the powder always consists of nothing but impurities, or whether it still retains some quinon, as in a few cases the melting-point tends to indicate.

Although I have not completed my experiments in that direction, I shall shortly be able to definitely settle this point by practical tests.

But I think it advisable not to delay the publication of my results hitherto obtained, as I am satisfied of the correctness of separating crystals and powder and of its undoubted advantage over the other known test.

I have meanwhile brought my test into practical working by taking the crystals as pure quinon, and by considering the powder as valueless impurity in all cases where the melting- and solidifying-point is below 270° or above 280°, and by adding the powder to the crystals as quinon whenever these two points range between 270° and 280°.

This compromise, for such I admit it to be at the best, has given general satisfaction to those who had it tried; and although I hope in a short time to complete my investigation, I meanwhile propose the above test, which, briefly stated is as follows:—

Boil 1 grm. of the sample for four hours with 15 grms. of chromic acid dissolved in 10 c.c. of glacial acetic acid and 10 c.c. of water; allow it to stand for twelve hours, collect the crystals on a small filter, and let the solution run off to the last drop; then wash the crystals with boiling water till the filter and filtrate are quite colourless, dilute the filtrate with water to 600 c.c., let stand for two hours, and collect the powdery precipitate on a filter and wash well. Then treat both crystals and powder—separately, of course—with potassium permanganate and potassium hydrate as hitherto, collect each on a double filter, dry and weigh, but do *not* add the correction; then take the melting- and solidifying-point of both. The

crystals to be taken as pure quinon, the powder also to be taken as quinon if melting- and solidifying-points range between 270° and 280°, but as valueless impurities if these two points are below 270° or above 280°.

This test is more reliable, and more just to buyer and seller, than either the usual quinon test or the one now proposed by Messrs. Meister, Lucius, and Brüning.

My experience as to the action of sulphuric acid upon crude quinon is as follows.

(To be continued.)

NOTES OF WORK BY STUDENTS OF PRACTICAL CHEMISTRY IN THE LABORATORY OF THE UNIVERSITY OF VIRGINIA.

No. V.

Communicated by J. W. MALLET,
Professor of General and Applied Chemistry in the University.

(Continued from p. 169.)

(3.) *On the Chemical Character of the Pigment of the Negro Skin.* By Dr. F. P. FLOYD, of Tazewell Co., Virginia.

It is natural to suppose that the substance which gives the characteristic black colour to the skin of the negro is probably modified blood pigment, as is pretty generally assumed to be the case in reference to the "melanin" of the choroid coat of the eye; but this point does not seem to have been made until now the subject of experiment. I suggested to Dr. Floyd to examine qualitatively the character of the pigment in question, and to get, if possible, some approach to a determination of the amount of iron in the ash as the means of testing the probability of a connection with hæmatin.

Strips of cuticle with a little of the outer layer of true skin attached were taken from a negro cadaver, and having been well washed with water and alhohol, and with ether to remove fatty matter, were cautiously scraped with the blunt edge of a scalpel, in order, if possible, to loosen up the pigment granules and permit of their separation and purification by mechanical washing. A very little examination with the microscope, however, showed that this could not be done without breaking up the whole substance of the cuticular tissue, and mixing its *débris* with the granules, which therefore could not be obtained in a state of purity. By selecting only those parts in which there was most pigment, and cautiously treating these as above, enough of it was procured with but little admixture to establish the following points. The colouring matter is insoluble in water, alcohol, and ether. It is also undissolved by treatment with dilute acid or alkaline solutions. It is but slowly attacked by the strong acids, even by concentrated nitric acid. Chlorine, especially in the presence of alkalies, completely destroys it. Heated for some time with a strong solution of sodium hydrate it is gradually dissolved, and the solution when diluted yields a partial precipitate on neutralisation with an acid. In all these respects the behaviour of this substance agrees perfectly with the melanin of the eye.

In order to get an approximation to the quantity of iron present, as the pure pigment could not be had, comparative experiments were made with the cuticle of black and white subjects with the following results:—

No. 1.—*Skin from the outside of the upper arm of a Negro man, aged about 50 years, born in United States.*—The cuticle and a little of the outer portion of the cutis were taken, washed with water and alcohol, macerated in ether for twenty-four hours to remove fat, and then dried at 100° C. 21·249 grms. of the dry material on being carefully and completely burned left 0·424 grm. of ash = 2·0 per cent. This ash was dissolved in a very small quantity of sulphuric acid, the solution diluted, and the iron (easily diluted in previous quantitative experiments) reduced to a ferrous salt by a minimum of pure zinc, determined by a much diluted solution of potassium permanganate. The result was 0·00859 grm. of Fe = 2·02 per cent of the ash.

No. 2.—*Skin from the outside of the thigh of a Negro woman, aged about 40 years, born in Virginia.*—The cuticle was rather more completely separated from the true skin than in the last instance. The same treatment was applied. 2 grms. of material dried at 100° C. left 0·056 grm. of ash = 2·8 per cent, and in this there was present 0·00142 grm. of Fe = 2·54 per cent of ash.

These specimen of negro skin were obtained from the Anatomical department of the University of Virginia; for those from white subjects, which at the time were not available here, we were indebted to my friend Dr. Souchon, of New Orleans.

No. 3.—*Skin from the anterior surface of the thigh of a white man, 40 years of age, born in Maine.*—The epidermis was taken off pretty clearly, with very little of the true skin remaining attached to it. Same chemical treatment as above. 18 grms. of the dry cuticle gave 0·207 grm. of ash = 1·15 per cent, in which was found Fe = 0·00235 grm. = 1·13 per cent of the ash.

No. 4.—*Skin from anterior surface of upper portion of thigh of a white man, aged 45, born in France.*—Cuticle taken off as clearly as possible and treated as before. 15·354 grms. of dry skin gave 0·175 grm. of ash = 1·14 per cent, yielding 0·00226 grm. of Fe = ·29 per cent of the ash.

It appears from the mean of these results that the negro cuticle leaves on being burned double as much ash as that of the white man (2·40 per cent against 1·15), and that the difference is nearly as great in the percentage of iron in the ash (2·28 against 1·21), thus rendering the presence of a considerable amount of iron in the black pigment highly probable, and increasing the likelihood of this being a product of the alteration of the colouring matter of the blood.

As regards the local distribution of the pigment granules there seems to have been hitherto a little confusion of statement. In the older books they are said to occur in the "*rete mucosum*" between the epidermis and cutis, and, although the existence of such a distinct middle layer of the skin is no longer admitted and the name for it has therefore disappeared, the same general idea seems to remain that the colouring matter belongs to the subcuticular portion of the skin, and hence impliedly that it does not extend outwards into the cuticle itself. I have found too in the Southern States many physicians under the impression that a blister produced upon the negro skin is white, or at any rate much lighter in colour than the surrounding surface. From the chemical inalterability of the pigment, as above ascertained, this would seem very unlikely; a few observations were therefore made upon the subject.

Thin *vertical* sections of negro skin from the cadaver were made, and these under the microscope showed brown and black granules to the very edge of the cuticular surface, which, however, seemed to have been partially removed, probably by *post mortem* softening and the washing which the subject had received.

A few extremely thin horizontal shavings were therefore taken off with a razor-like scalpel from the arms of two living negroes, man and woman respectively, drawing no blood and cutting with the blade so slanted as to thin off one side of the shaving to nothing. These sections showed under the microscope the pigment granules through the whole of the cuticle, though less easily observed among the epidermic scales than in the less dense structure beneath in which the flattening of the cells had not yet gone so far. Finally, one or two small blisters were produced by very small drops of a solution of cantharidine, and the raised cuticle from these gave quite th

same result under the microscope. The blisters themselves before being punctured were distinctly brown to the naked eye, while no doubt the side light which comes in through the projecting mass of transparent colourless fluid has a tendency to produce the impression of lighter colour upon the observer.

There can be no doubt, I think, that the brown or black pigment originates in the outer layer of true skin, its production being probably connected with the loss of vitality of the cells, and that it accompanies these cells all the way to the surface, where it is mechanically removed by disquamation. The chemical modification of the red colouring matter of the blood corpuscles may possibly be in some way dependent on feebleness of circulation in the superficial capillaries, to which would seem to point a number of facts as to the diseases to which negroes are specially liable, as well as their extreme sensitiveness to low atmospheric temperature, a severe frost which would be little more than bracing to a white man often fairly benumbing all their faculties, bodily and mental.

(4.) *Analysis of Cinnabar from Oregon.* By C. W. Dabney, Jun., of Hampden Sidney College, Virginia.

A specimen of cinnabar in calcite from the land of Dr. F. C. Horsley, near Canyon City, Oregon, when pulverised and treated with dilute hydrochloric acid, gave off sulphuretted hydrogen. This fact seemed to make it worth while to analyse the specimen carefully, and it was placed in Mr. Dabney's hands for the purpose. It was found that after being thus treated with acid it gave, on heating in a closed tube, a small sublimate of sulphur, and the residue on being again treated with hydrochloric acid gave an additional amount of sulphuretted hydrogen, whilst iron was found in solution.

A specimen freed from the calcite gangue by very weak acetic acid was dried, weighed, and acted on with hydrochloric acid of 6 per cent real acid. The sulphuretted hydrogen given off was collected as sulphide of silver, and its amount determined. The residue was then analysed by ordinary methods, adding in the small quantity of iron which the hydrochloric acid had taken up. The results were :—

Mercury		78·42
Sulphur	{ given off as H_2S 0·54 ; in residue 13·59 }	14·13
Iron		4·09
Silica		3·06
Oxygen (by difference)		0·30
		100·00

From the behaviour of the mineral with hydrochloric acid and on heating it may fairly be concluded that part of the iron exists as ordinary iron pyrites and part as magnetic pyrites. If now the sulphur be distributed, first, to mercury to form HgS ; second, to the extent of that evolved as H_2S, to iron to form magnetic pyrites (assuming this to be Fe_7S_8) ; and, third, the residue, to iron enough to form iron pyrites, the rest of the iron being assumed present (as some visibly was) as ferric oxide ; the above analysis will stand thus :—

HgS	90·97
Fe_7S_8	1·37
FeS_2	1·95
Fe_2O_3	3·36
SiO_2	3·06
	100·71

These results may serve to explain, at least in some cases, the abnormal proportions of sulphur and mercury in the published analyses of cinnabar, the iron having hitherto always been reported present as ferric oxide, and no other mode of combination suggested for the sulphur, which is almost always in excess. Thus in the analyses given by Dana and Rammelsberg, neglecting other constituents—

No.	Locality.	Analyst.	For 200 parts Hg we have of S.
1.	Neumarktel	Klaproth	33·52
2.	Japan	,,	34·90
3.	,,	John	44·64
4.	Westphalia	Schnabel	31·50
5.	Wetzlar	,,	44·42
6.	California	Bealey	32·82
7.	Idria (hepatic)	Klaproth	33·62

instead of 32·0, as demanded by theory. In the third and fifth of these analyses native sulphur was probably present.

(To be continued.)

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 167.)

Chlorine, Bromine, Iodine, and Fluorine.
By Dr. E. Mylius, of Ludwigshafen.

We may here also mention the bromiferous artificial saline mixtures prepared in imitation of the salts obtained from mineral springs.† At Vienna the mother-liquors and their salts of Kreuznach, Kœsen, Wittekind, &c., were exhibited by Frank, and by the United Manufactures of Leopoldshall. Finally, we must mention the arrangements adopted for preserving the workmen from the injurious action of bromine. It appears, in fact, that when these are applied no danger to health is to be apprehended. In the selection of workmen it is primarily essential to see that they have well-developed respiratory organs, and are free from any predisposition to asthma and catarrhal affections. The use of spirituous liquids must be strictly interdicted, as the irritability of the mucous membranes which they produce is exceedingly dangerous. On the other hand, a generous diet is recommended, and especially the abundant use of fatty and mucilaginous articles, butter, bacon, &c.

As it appears that the workmen do not make use of the respirators with which they are furnished, and at most merely tie a cloth over the mouth and nose when decanting large quantities of bromine, the most important point is to secure an efficient ventilation in all parts of the works. By attention in this respect, combined with the above-mentioned dietetic regulations, it has been found practicable to maintain the health of the workmen at Stassfurt, during the eight years of the existence of the bromine manufacture, so long as they refrain from the use of spirituous liquors (Frank).

(The editor of this Report has had opportunity during a recent excursion to Stassfurt to visit Frank's bromine works, and, it may be, permitted him to add certain results from his own observation in order to complete what has above been given in bold outline.)

The distillation of bromiferous mother-liquors with manganese and sulphuric acid is conducted in large cubic stone vessels made in one piece, and belted with iron bands in case of a fracture. Their average capacity is 3 cubic metres. At some distance from the bottom is a perforated plate of the same kind of stone, upon which the manganese is placed in fragments of the size of a nut. The stone trough is covered with a heavy plate of the same material, which is raised and lowered by means of a rope with a counterpoise playing over a pulley. In this cover there is introduced a thick stoneware pipe for the introduction of steam ; and it is also provided with a man-hole,

* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzehends."

† In Germany such saline mixtures are used under the name of "bath salts" (*bade-salze*).

an aperture for pouring in the bromiferous liquid and the dilute sulphuric acid, and an opening for the escape of the bromine vapours.

Few stones are suitable for the construction of these vessels, and when the bromine manufacture was introduced at Stassfurt there was great difficulty in finding a suitable quality. Almost all the stones tried experimentally after a time allowed the chloride of manganese to ooze through, and required to be coated with tar to overcome this defect. This, however, gave rise to a new inconvenience, considerable quantities of bromine being lost by the conversion of the hydrocarbons of the tar into bromine compounds, and the bromine itself becoming contaminated. Dr. Frank estimates the loss for every new coating of tar at about 50 kilos. of bromine. Latterly a kind of stone has been found in the neighbourhood of Porta Westphalica which does not require this costly preparation and can be used at once. Still the high price of these stone troughs has given rise to attempts to manufacture bromine stills with large plates of slate, cramped together with iron bands and screws. A final decision has not yet been obtained.

(To be continued).

NOTICES OF BOOKS.

How to Avoid Typhoid Fever and Allied Diseases. By Arthur H. Downes, M.B., M.D. London: Baillière, Tindall, and Co.

This pamphlet gives plain and useful directions how to prevent the introduction of sewage-gases into dwellings. The dangers of allowing water-closets to be supplied from the same cistern which furnishes water for the culinary purposes of a household is clearly shown; so also are the shortcomings of the ordinary drain-traps, and of sinks which lead direct into the sewer. The author urges that water-closets should always be built projecting from the house, and be provided with a kind of ante-chamber fitted with a window on each side, so that the closet itself may not be ventilated into the house. Such arrangements are certainly very desirable, but unfortunately they are beyond the reach of the many. In some towns the closets are placed in the interior of the houses, without any window or any other direct communication with the open air. But even this is not the worst. We once observed clouds of steam issuing from the closet in a certain hotel where our evil star had led us to take up our quarters, and we fear that there must have been some connection with the hot-water cistern in the kitchen.

Dr. Downes denounces the vile practice of placing the foundations of houses upon "made ground."—*i. e.*, accumulations of putrescent rubbish. For this offence an appropriate legal enactment, with penalties heavy enough to penetrate to the conscience of the wealthiest contractor, is sorely needed. Not less do we require a stringent measure prohibiting the passage of drains beneath the flooring of houses, a mal-practice against which a large number of medical health-officers have formally protested.

Dr. Downes gives instances where the excreta of a patient suffering from typhoid fever having been thrown upon a dunghill, communicated the disease afterwards to men employed in carting the heap away. It is exceedingly probable, therefore, that fields irrigated with sewage containing fever "germs" will communicate the disease to persons employed in their cultivation. The author indeed remarks, in a foot-note,—"There is no evidence to show that even when a cow has been fed upon sewage-manured grass the milk acquires any infectious property *per se*." But there is evidence to show that the juices of sewage-grass differ in their properties and behaviour from those of natural grass, and that the milk of cows fed upon sewage grass enters into putrefaction much more rapidly than that of cows placed upon ordinary diet.

In speaking of epidemics of typhoid fever the author states—"In the case of the Marylebone epidemic, in 1873, the cause was traced to the milk from a certain farm far away in the country. The farmer had died of typhoid, and his excreta had contaminated a certain well, with the water from which the milk-cans were washed." We really were of opinion that this alleged Marylebone epidemic had been consigned to the realms of mythology. There is scarcely a sound link in the chain of evidence which was produced on the occasion. The deaths from typhoid in the district, at the time given, were below the average. The farmer was certified as having died of a disease of the heart. The water of the accused well was used for domestic purposes by several people in the village, none of whom were attacked with enteric fever.

A regular inspection of dairies, as Dr. Downes recommends, would be an exceedingly difficult thing to carry out in practice, and would assuredly be avenged upon consumers in the shape of a fearful rise in the price of milk and butter.

Upon the whole we must say that this little work deserves a wide circulation, and is calculated to effect much good.

*Vegetable Fibre, and its Preparation for Industrial Uses** By Dr. Hugo Müller (of London). Brunswick: F. Vieweg.

This valuable work is a reprint from the official report of the Vienna Exhibition of 1873. The author sets out with an account of cellulose, the formation of wood and cork, textile vegetable tissue, the nature of the bleaching process, the distinctive characteristics of the different vegetable fibres, the quantitative determination of cellulose, and the hygroscopic nature of vegetable fibre. On the latter very important subject the author gives a table, from which we learn that Belgian flax in its air-dried condition contains 5·70 per cent of water, cotton 6·66, and Manilla hemp as much as 12·5. In air saturated with aqueous vapour the amounts taken up are much greater. Thus cotton absorbs 20·99 per cent, and Manilla hemp 40. These figures have not merely a commercial importance for the purchaser of fibrous materials, but they are even more interesting as regards public health. Substances which when supposed to be dry may contain 6 per cent of water must certainly have a deleterious effect when worn next to the skin. An astonishing number of coughs and rheumatic attacks, and in tropical climates of more acute diseases, are due to the linen and cotton under-clothing still worn by so many.

On the recognition of the different vegetable fibres Dr. Müller very justly remarks that this end cannot, as a rule, be effected by chemical means, since the essential substance present, cellulose, must when pure give always the same reaction. Only in exceptional cases certain raw fibres give characteristic coloured reactions due to their less important constituents. Thus *Phormium tenax*, New Zealand hemp, gives a red coloration with nitric acid, and jute and its allies a yellow colour with the sulphate of aniline; but when the fibres have been bleached these distinguishing reactions no longer appear. The microscopic characteristics are more widely available. As has been shown by the researches of Wiesner, almost all vegetable fibres under the microscope display features by which they may be recognised. In addition to the generally constant length, breadth, and thickness of the membrane of the cells which constitute any given fibre, there are commonly detected other histological elements and crystalline mineral inter-deposits, which together form a basis for methodical examination. The application of certain micro-chemical reagents—such as ammoniuret of copper, sulphuric acid and iodine, sulphate of aniline, &c. —is of great value. Still the detection of a manufactured fibre remains a task which requires no little skill and experience.

* "Die Pflangenfaser und ihre Aufbersitung für die Technik."

For the quantitative determination of cellulose Dr. Müller proceeds as follows:—Two grms. of the material in question are dried at 110° to 115°. If resins, wax, &c., are present, they are extracted with a mixture of strong alcohol and benzol, and the mass is then repeatedly boiled with water or very dilute ammonia. The residue is then bruised in a mortar with a pestle of box-wood. In operating on woods fine plane-shavings are the most convenient form, and require no further preparation. The mass is now placed in a large wide-mouthed stoppered glass, with 100 c.c. of water. A solution of bromine, containing 2 c.c. of bromine to 500 c.c. of water, is then added, to the extent of 5 or 10 c.c., according to the nature of the material. When the yellow colour of the liquid disappears a fresh portion of the bromine solution is added, and so on until free bromine may be recognised in the liquid, even after standing from twelve to twenty-four hours. The mass is now filtered, washed with water, and heated nearly to a boil, with about 500 c.c. of water to which 2 c.c. of ammonia have been added. The mass is filtered, washed with water, returned to the stoppered glass, and again treated with water and solution of bromine, as before. This alternating treatment with ammonia and bromine is thus repeated three or four times, and finally—on washing with water, and then with boiling alcohol—pure cellulose is obtained as a mass, dazzling in its whiteness. It may be considered pure if—after remaining for twenty-four hours in contact with very dilute solution of bromine, and subsequent treatment with warm dilute ammonia—no coloration appears in the liquid.

The author is of opinion that the determination of cellulose will become of practical importance in the future, as new fibrous materials will doubtless be introduced into the market, and as it will become necessary to ascertain the result of the various processes for their preparation.

The remaining and larger portion of the work is devoted to an elaborate description of the vegetable fibres already in use, and of those capable of industrial application, the number of which will surprise those who have not examined this subject. Particular attention is given to a survey of materials suitable for the paper-trade, and to an account of the improved processes, mechanical and chemical, for its preparation.

We must strongly recommend Dr. Müller's work to all who take an interest in vegetable fibres and their applications, and especially to all concerned in textile manufactures, in the paper-trade, and in the development of the resources of our colonies.

CORRESPONDENCE.

REPORT OF STATE BOARD OF HEALTH OF MASSACHUSETTS.

To the Editor of the Chemical News.

My attention has recently been called to your issue of July 28, in which I find a review of the last report of the State Board of Health of Massachusetts; I rely on your candour and courtesy to give equal prominence to my reply.

First, as regards Leeds, my statements are, in the main, corroborated by the prospectus of "The *Clarifying* and Utilisation of Sewage Company" (asknowledging by their very name that they do not assume to *purify* the sewage), by authorities whom I have quoted, and by articles in the *Leeds Mercury* and the *Yorkshire Post*, of December 23, 1874, although I may have misunderstood my informant, who was an intelligent man, familiar with the details of the work, as to some unimportant matters. I do not know how the error occurred by which I made the number of tanks six instead of twelve, unless by mistake in copying or proof-reading, which I failed to detect; it does not appear in my notes. You say—"The author admits the absence of offensive smell. Here he contradicts one of the most preposterous assertions of the Rivers' Pollution Commission, that 'bad smells are always perceptible.'" My statement is—"There is no offensive smell . . . . *except from the moist precipitate*" (p. 349).

As to Leamington, I find my notes confirmed by the London *Standard* of October 17, 1874, and by the London *Times* of October 21, 1875. I am sure that the authorities will not say that my expression of "costly and expensive failures," as applied to their experience with the precipitating processes, is at all too strong.

You say—"No mention is made of the important results obtained by Mr. Smee, jun., who showed that milk and butter obtained from cows fed on sewage grass became more rapidly offensive than that of cows fed upon normal herbage. No notice is taken of the important evidence of Mr. Markham that irrigation, even with common river water, and applied only when necessitated by dry weather, injures the health of the surrounding districts in India. No less has Dr. Folsom left out of account the valuable report of M. Lefeldt, the Prussian Commissioner, who complains of the 'mephitic odours' on *the* model sewage farm, and who found the stems of grass from irrigated meadows full of unassimilated sewage matters."

I have given more than a page to the consideration of Mr. Smee's statement (pp. 344 and 345). I have distinctly stated the fact well known to Mr. Markham and others with regard to irrigation in India (p. 335). The "mephitic odours" found by Lefeldt on "*the* model sewage farm,' (Breton's Farm) were due, as he says on page 6 of his Report, lines 24, 25, 26, not to the process of irrigation, but to the precipitating tanks, which he and I both condemned. His other statement, with reference to the Craigentinny Meadows, is that "*when the rye-grass is irrigated within two days of the time of cutting* a rank growth was produced which cattle do not eat, and which was full of unassimilated sewage *for a few inches above the roots*." This fact he did not consider of sufficient importance (being due to bad management) to mention at all in his general *resumé*. Finally, Lefeldt says that sewage distribution, if properly managed, does not create more stink than is ordinary on farms (pp. 13 and 54), and (p. 48) that there was a horrible smell (*Ein entsetzlicher Geruch war damit verbunden*) from the drying of the precipitate in the A B C process, even when special care was taken at the time of his pre-arranged visit with the chief engineer.

As to England, I have given my authorities, and there I am content to let the matter rest.—I am, &c.,

CHAS. F. FOLSOM.

Boston, September 1, 1876.

[In inserting Dr. Folsom's letter we cannot see that he has in any way substantiated those statements upon sewage precipitation which we denounced as grossly inaccurate. As regards Leeds, surely the name which a local company has thought fit to assume, even if backed by random newspaper articles, is a curiously feeble argument to set against the official reports and certificates of the responsible authorities, the analyses of a chemist like the late Dr. Letheby, and the observations of scientific men made during prolonged and reiterated visits of inspection! The informants who misled Dr. Folsom into speaking of six tanks of iron in place of twelve of stone may well be deemed inaccurate in matters less obvious, and may possibly have evolved the odour of the mud out of the depths of their own consciousness. Dr. Folsom's statement that "there is no offensive smell *except from the moist precipitate*" does not agree with the declaration of the Rivers' Pollution Commissioners that "bad smells are *always* perceptible;" so that we cannot withdraw the compliment which we offered him. As concerns Leamington, whatever *canards* may have found their way into the papers, our statement is an indisputable truth. When we read the next paragraphs of Dr. Folsom's letter we began to fear that we had inadvertently made an unfounded accusation. But we turned to "page 335," and

found no mention whatever of Mr. Markham or of his report, *not a word to prove that Dr. Folsom was aware even of his existence!* We turned next to "pages 344 and 345," and found matters very little better. *Three lines* are given to a notice of Mr. Smee's letter to the *Times* in 1873, but the more recent work of Mr. Smee, jun., to which we referred, is not noticed. The remainder of the "more than a page" consists of "opinions" and negative evidence, of very little value when opposed to actual experiments. As regards the "mephitic odour" on Breton's Farm, Dr. Folsom's attempt to explain it away is ingenious, but cannot be admitted for a moment. The *settling*-pits (not *precipitation*-pits, which would imply the use of a precipitant) were part and parcel of a system of irrigation. If abolished, the solid impurities which they were intended to retain would be scattered over the whole farm, and would produce a nuisance less concentrated but more general. If unassimilated fœcal matters can penetrate into living vegetable organisms at all, who dares to fix the time required to render them harmless? If there is anything wrong on a sewage farm it is always ascribed to "bad management." But if there is the slightest nuisance at any precipitation works it is charged as a fundamental error to *all* sewage processes. To M. Lefeldt's allegation, that an evil odour arises from precipitation-manure on drying, we may oppose the testimony of Mr. Keates, an authority no less eminent than impartial. We will merely add that Dr. Folsom's remarks on Leeds and Leamington could be refuted, if necessary, both by official documents and oral testimony sufficient to satisfy any court of justice.—*Ed.* C.N.

THE PINK LIQUORS OF THE CHLORATE OF POTASH MANUFACTURE.

To the Editor of the Chemical News.

SIR,—It has often been said that the rose-red colour which appears upon the complete saturation of the lime with chlorine in the manufacture of chlorate of potash also appears in the absence of manganese, and as it is well known that this colour is due to permanganic acid, I was not a little surprised to find Dr. Mylius (CHEMICAL NEWS, vol. xxxiv., p. 139) giving even slight credence to the statement that this colouration could appear "in the absence of manganese." In the same paragraph it is also stated that the rose-red colour is also obtained in the absence of manganese at Messrs. Kunheim's works at Berlin, where Deacon's process is used for the preparation of the chlorine, leading one to suppose that the colouring matter was other than permanganic acid in this case.

In *Dingl. Polyt. Journ.*, ccxv., p. 237, Opl states that an unfiltered chloride of lime solution becomes rose-coloured on boiling by the formation of ferric acid from the ferric oxide of the calcium hydrate employed. Now, from experiments made at intervals during the last five years, I find that the colour is *always* due to permanganic acid, and that the manganese is not carried over mechanically with the chlorine; but the permanganic acid is formed by the continued action of the chlorine upon the manganese compounds contained in the lime used in the process.

I have examined many samples of lime, limestone, and chalk, but have not met with one yet absolutely free from manganese; and, furthermore, all the pink liquors from the chlorate manufacture, bleaching-powders and bleaching-liquors, made either by Deacon's process, Weldon's process, or the old process, have all yielded manganese on analysis, and the corresponding pink solutions, when examined by the aid of the micro-spectroscope, have *all* given the characteristic absorption spectrum of potassium permanganate—the five well-known bands in the yellow and green.—I am, &c.,

GEORGE E. DAVIS.

30, Faulkner Street, Manchester.

PROF. DITTMAR AND THE "ANALYST."

To the Editor of the Chemical News.

SIR,—My object in troubling you with my former letter was to do an act of justice to Prof. Dittmar, viz., to prevent the assailants of Prof. Dittmar from passing off their own private act as the public act of a Society which refuses to take part in it; and my position as one of the Vice-Presidents of that Society, and as chairman of the meeting which condemned the attack on Prof. Dittmar, made it my clear duty to interfere.

As I have already mentioned, the *Analyst* was registered in the names of Mr. Wigner and Dr. Muter as proprietors, and in the last resort the control of the paper and the legal responsibility rest with these two persons.

The six persons forming the Committee of Publication are the President of the Society (Dr. Redwood), myself, Dr. Muter, Dr. Dupré, Mr. Heisch, and Mr. Wigner. The editorship of the *Analyst* is in the hands either of Mr. Wigner or of some person in his employ.

I have the permission of the President (Dr. Redwood) to record that the article under discussion was published without his knowledge or consent. I take this opportunity of formally recording that it was published without my knowledge or consent; and in his letter which appeared in the CHEMICAL NEWS (vol. xxxiv., p. 162) Dr. Muter has disclaimed all knowledge or consent. I call attention to the circumstance that in the letter signed conjointly by Mr. Heisch and Dr. Dupré those gentlemen omit to say whether they were present at any committee meeting sanctioning the issue of the article on Prof. Dittmar, and confine themselves to a general expression of responsibility: and with all these facts before them I do not doubt that the real character of the attack on Prof. Dittmar will be obvious to your readers.—I am, &c.,

J. ALFRED WANKLYN.

117, Charlotte Street, Fitzroy Square, London, W.
October 24, 1876.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances, de l'Academie des Sciences. No. 14, October 2, 1876.

Industrial Application of the Sun's Rays.—M. A. Mouchot.—The author presents to the Academy a small "solar alembic," easy to set up and to remove. The mirror is 50 c.m. in diameter; the boiler contains 1 litre of wine, which is brought to a boil by half an hour's exposure to the sun. The vapour of alcohol enters a tube placed in the centre of the boiler, traverses the foot of the mirror, and descends into the worm, where it condenses. The foot of the mirror is a gas-tap fitted with a groove and a set-screw, which permit the boiler to be always turned to the sun. If the boiler is filled with water, and if a receptacle full of leaves or odoriferous flowers is interposed between it and the worm, all the essences procurable by distillation may be obtained.

Influence of Temperature upon Magnetisation.—J. M. Gaugain.—Not suitable for abstraction.

Chemical Reactions of Gallium.—M. Lecoq de Boisbaudran.—Solution of *pure* gallium, mixed with acid acetate of ammonia, are not rendered turbid by sulphuretted hydrogen, but if zinc is present the sulphide of this metal is charged with gallium, but the liquid is not entirely freed from it. If the salts of zinc are not plentiful enough to draw down at once all the gallium precipitable by sulphuretted hydrogen, it must be added in small portions

until these products no longer give the ray Ga α 417·0 in the spectroscope. Only slight traces of gallium remain then in the liquid. On proceeding thus, the amount in the precipitates appears to remain at first almost constant, or at least to decrease slowly, and then more and more rapidly: it does not, therefore, seem to be a function of the amount of gallium in the liquid. Is there not here an indication of a combination between the two substances, or perhaps more probably a surface-attraction analogous to the fixation of a colouring matter upon a mordant. It is known that salts of zinc slightly acid are precipitated by sulphuretted hydrogen, the action being limited by the quantity of strong acid set at liberty. If the experiment is made with a chloride of zinc containing gallium, a notable quantity of this metal falls along with the sulphide of zinc. An ammoniacal solution of the salts of gallium and zinc is precipitated by hydrosulphate of ammonia. An excess of the reagent does not remove the gallium, unless, indeed, the sulphide of zinc is in such small quantity as to dissolve also. The case is different when the salt of gallium is pure. The ammoniacal solution is not rendered turbid by the sulphide of ammonium. If a neutral or slightly acid solution of the chlorides of zinc and gallium is submitted to fractionated precipitation with sulphide of ammonium containing free ammonia, the gallium is concentrated in the first products. If an ammoniacal solution of zinc and gallium is submitted to the same treatment, the gallium, on the contrary, accumulates in the last precipitates.

Syphonment and "Migration" of Gases.—M. F. Bellamy.—The phenomena classed here as "migration" are cases of gaseous osmose. The author has given them the name of "migration" to distinguish them from osmose, properly so-called, which is effected through *septa*, conductors of large surfaces and very small length. In "migration" the conductor presents a narrow surface and a length relatively great.

Bulletin de la Societe Chimique de Paris,
Nos. 4 and 5, September 5, 1876.

Transformation of Aromatic Carbides into Formenic Carbides.—M. Berthelot.—The author remarks that in effecting total hydrogenations with hydriodic acid and phosphorus, red phosphorus should not be used, since it dissolves completely at the temperature required, and gives rise to such a great formation of gas that the tubes cannot be preserved.

Thermo-chemical Researches on Lead and Thallium.—M. J. Thomsen.—(*Journal fur Praktische Chemie.*)

Thermo-chemical Researches on Copper and Silver.—M. J. Thomsen.—These two papers consist merely of columns of formulæ and figures.

"Action of Mass" of Water.—M. W. Ostwald.—The author has studied the decomposition of bismuth chloride by water increasing with the quantity of the latter.

Borates of Lithium.—M. F. Filsinger.—The author has obtained a biborate and four other compounds, or possibly mixtures.

Crystalline Fluosilicates of Iron and Cobalt.—M. F. Stolba.—The author prepares the former of these two compounds by dissolving metallic iron in hydro-fluosilicic acid, and the latter by decomposing the carbonate of cobalt with the same acid.

Purification of Bisulphide of Carbon.—M. L. H. Friedburg.—The author distils the sulphide over a pure vegetable fat, such as palm oil. To free the sulphide of carbon from a little fatty matter which it carries over, it is poured into fuming nitric acid, stirred, and allowed to digest for twenty-four hours. It is then mixed with cold water, distilled at 50° or 60°, mixed with water again, and re-distilled, when it is obtained perfectly pure.—*Berichte der Deutschen Chemischen Gesellschaft zu Berlin.*

Quercitrin and Quercetin.—M. J. Lœwe.—Quercitrin is generally regarded as a glucoside which is split up under the influence of acids into quercetin and sugar (the isodulcite of Hlasiwetz and Pfaundler). The author combats this view, and seeks to demonstrate that quercetin differs from quercitrin merely by containing two equivalents of water less.

Density of Nitric Acid at Different Temperatures.—M. H. Gœbel.—A table showing how the hydrometric value of nitric acid is affected by changes of temperature.—*Dingler's Polytechnisches Journal.*

Researches on the Kainite of Kalusz in Galicia.—M. H. Schwarz.—There are found at Kalusz deposits of pure sylvine (chloride of potassium) and of kainite. This latter is found in yellowish grey fragments, generally moist from the presence of chloride of magnesium. On analysis it is found to be a tolerably constant mixture of the double sulphate of potassium and magnesium (picromerite or schœnite), chlorides of sodium and magnesium, and clay in variable quantities.

New Process of Dyeing with Artificial Alizarin.—M. R. Forster.—The author fixes first the aluminous mordant, and then a mixture of alizarin and of fatty acid, by operating as follows:—He dissolves a sufficient quantity of alizarin and of soap, and then neutralises the solution with sulphuric acid. The alizarin and the fatty acid are precipitated in very finely divided flocks, which attach themselves very readily to the mordanted tissues, giving very bright and solid colours.

Distinctive Reaction between Reds from Artificial Alizarin and those from Extract of Madder.—M. J. Wagner.—The author finds that extract reds are very much injured by a mixture of soda and potassic ferricyanide, whilst artificial alizarin-reds are scarcely affected. This difference is doubtless due to the presence of purpurin in the extract which is destroyed by this reaction.—*Bulletin de Mulhouse.*

Solution of Damaged Albumen in Pepsin.—M. J. Wagner.—The author utilises damaged lots of albumen by dissolving them in pepsin. The solutions thus obtained give, according to his account, colours almost as solid as albumen of the first quality. Nevertheless, the albumen thus re-dissolved is no longer coagulable by heat, and the degree of solidity of the colours fixed by its intervention is not comparable to that of colours fixed by unmodified albumen. The process, therefore, is only applicable in certain cases.—*Moniteur de la Teinture.*

Formation of Aniline-Black.—M. Rich. Meyer.—An acid solution of pure aniline sulphate gives, on the addition of a concentrated solution of MnO_4K, a deep olive-green precipitate, verging upon black, but which cannot be totally deprived of sulphuric acid. The author considers that the original precipitate is a sulphate which is gradually decomposed by washing. This body presents the general characters of aniline-black. It is insoluble in alcohol, ether, benzol, and acetic acid, to which, however, it still imparts a more or less olive tint. Concentrated sulphuric acid dissolves it with a black-blue colour, but it is re-precipitated on the addition of water. If the sulphuric solution is heated SO_2 escapes, and the liquid becomes a dirty brown. Further researches are required to ascertain if this black is identical with that of M. Coquillion and M. Goppelsrœder.

On Litmus.—M. V. Wartha.—The blue colouring matter, indifferent to acids, often found in blocks of litmus, is simply indigo, which, in the author's opinion, is intentionally added to heighten the blue colour. It may, however, result from the fermentation of the lichens at the expense of the urine added.

County Analyst for Warwick.—On the 17th inst. Mr. A. Bostock Hill, M.D., was elected Analyst for the County of Warwick.

MISCELLANEOUS.

University of Oxford.—The following are the lectures to be delivered during the present term:—"Organic Chemistry (Phenic Compounds)," on Mondays and Thursdays, at noon, at the Museum, by the Waynflete Professor of Chemistry, Dr. W. Odling, M.A. Lectures "On Elementary Organic Chemistry" are given by the Aldrichian Demonstrator of Chemistry, Mr. W. W. Fisher, M.A., of Corpus Christi College, on Wednesdays and Saturdays, at 11 a.m.; and lectures "On Elementary Inorganic Chemistry," by Mr. W. F. Donkin, M.A., of Magdalen College, on Tuesdays and Fridays, at 11 a.m. The instruction in the Laboratory of the University, which is open from 10 a.m. to 4 p.m. daily, is given by the Aldrichian Demonstrator, and by Mr. John Watts, D.Sc. A Course of Practical Intruction in Organic Chemistry is conducted by Mr. W. H. Pike, Ph.D. The Professor will be glad to hear from gentlemen who, having passed the necessary examinations for the degree of Bachelor of Arts, wish to carry on original work in the University Laboratory.

NOTES AND QUERIES.

Fluoride of Potassium.—Having seen a question asked for a ready process for the production of fluoride of potassium I should feel obliged if you would kindly allow me to give the following process which might be found of some use to "Fluorine":—By using a small leaden vessel having a diameter at the bottom 3¼", and 2½" at the top, to hold a pint, to which a cover is attached with two holes bored in it, one for putting the mixture through and the other for the delivery tube. 2000 grms. of fluor-spar is now placed in the leaden vessel in the state of *small lumps*, as it will be found to operate better in this state than powdered. 100 grms. of sulphuric acid to 20 grms. of water is then poured upon it; the hold is now plugged with a gutta-percha cork, and a tube put through a similar cork and placed in the other hole. Hydrofluoric acid is now given off by being allowed to pass into the vessel containing the potassium, with which it forms a fluoride, as the potassium eliminates the hydrogen. P.S.—I may add, heat is applied matter of course it boils at 19·4° = hydrofluoric.—LATENT.

MEETINGS FOR THE WEEK.

THURSDAY, Nov. 2nd.—Chemical, 8. "On some New Compounds of Potassium," by Sidney Lupton. "On certain Bismuth Compounds" (Part III.), by M. M. Pattison Muir. "On Phospho- and Arsenio-Cyanogen," by W. R. Hodgkinson. "On a Secondary Oxidised Product formed during the Reduction of Stannic Chloride," by W. R. Hodgkinson and G. C. Matthews. "Preliminary Notice on Pigmentum Nigrum, the Black Colouring Matter contained in Hair and Feathers," by W. R. Hodgkinson and H. C. Sorby. "On Barwood," by the late Dr. Anderson.

TO CORRESPONDENTS.

R. P. Davies.—It was a printer's error. See erratum.

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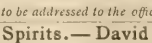

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THE CHEMICAL NEWS.

Vol. XXXIV. No. 884.

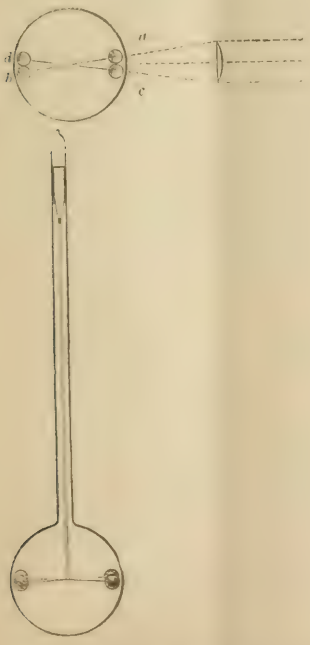
ON REPULSION RESULTING FROM RADIATION.—PART II.*

By WILLIAM CROOKES, F.R.S., &c.

(Continued from p. 176).

90. Experiment proves the above reasoning to be correct. A bulb-tube was prepared in the manner already described (84), but in it were suspended, by separate silk fibres, two glass stems, each having pith balls at its extremity. Fig. 3 shows the elevation and plan of the apparatus. The torsion of the silk fibres was so arranged that the pith balls *a b* hung freely about a millimetre from the balls *c d*. The glass stems were looped in the middle, and bent so that they did not touch each other. After complete exhaustion the following experiments were tried.

Fig. 3.



A beam of radiant heat was concentrated on to the two balls *a c*. When applied momentarily and then removed the radiation simply drove the balls apart, and immediately allowed them to come together again. When, however, the beam was allowed to play upon the balls for about half a minute they became warm and widely separated; and upon now removing the beam of heat the balls did not fall together at once, but took several minutes to regain their original position. This experiment therefore proves Case I.

The bulb and contents being of the ordinary temperature, a spirit-flame was rapidly passed round the bulb to warm it quickly on all sides. The balls were thus in the condition imagined in Case II., being in a space warmer than themselves. They immediately came together, *a* touching *c*, and *d* touching *b*.

Many experiments were tried with the object of proving experimentally the propositions in Cases III. and IV.; but with this apparatus it was found impossible to warm one of the balls without at the same time producing repulsion of the ball by the beam of radiation concentrated upon it. There is, however, little doubt, from the experimental proof of Cases I. and II., that the reasoning is equally correct in the other cases.

91. With a highly exhausted bulb and light pith index, which was found to be exceedingly sensitive to radiation, numerous experiments were tried to see if there was any difference in action between the fingers and a tube of water of the same temperature. Many persons believe that there is a peculiar emanation or *aura* proceeding from the human hand, and Baron Von Reichenbach† considered that he had proved this to be the case. Were this true it was not impossible that the emanation would affect the pith index. I have been unable, however, to detect the slightest action exerted by my own or any other person's hand which I could not entirely explain by an action of heat.

92. A similar series of experiments were tried with various large crystals, which were presented in different ways and with various precautions to the pith index. At first a decided action was observed; but in proportion as precautions were taken to eliminate the effect of heat, so was the action seen to diminish, until very little doubt was left in my mind that the slight residual action would have been entirely stopped had it been possible, with the apparatus then used, to altogether eliminate the action of heat.

93. Attempts were made to see if chemical action would attract or repel the index. I could not, however, produce chemical action close to the exhausted bulb, without at the same time liberating such an amount of heat as to mask any other action.

94. Although I most frequently speak of repulsion by *heat*, and in illustrating any of the results obtained I generally use either the fingers or the flame of a spirit-lamp as a convenient source of radiation, it must be clearly understood that these results are not confined to the heating-rays of the spectrum, but that any ray, from the ultra red to the ultra violet, will produce repulsion in a vacuum. I have already mentioned this fact in my first paper (58, 68). Experiments proving the similarity of action of all rays of the spectrum were shown before the Physical Society on June 20, 1874.‡ They were, however, tried with a less perfect apparatus than the one I have since used for the same purpose, and need not be further alluded to till I describe the most recent results obtained with the spectrum (110, 111).

95. Some experiments were tried with the object of ascertaining whether the attraction by heat, which, commencing at the neutral point (30 *et seq.*), increased with the density of the enclosed air, would be continued in the same ratio if the apparatus were filled with air above the atmospheric pressure. Two bulbs containing ivory needles suspended by silk fibres were accordingly adjusted to show the same sensitiveness to a hot body. One was

* A Paper communicated to the Royal Society, March 20, 1875. From the *Philosophical Transactions of the Royal Society of London*, vol. clxv., pt. 2.

† "Researches on Magnetism, &c.," translated by Dr. Gregory. London, 1850.

‡ *Phil. Mag.*, August, 1874

kept for comparison, and the other was attached to an apparatus whereby the internal air-pressure could be artificially increased by a column of mercury. A little increase of pressure was enough to show that the sensitiveness to radiation was greater; and under a pressure of 1½ atmosphere the superior delicacy of the ivory in the dense air was very marked. Attempts to carry the pressure to higher points failed, owing to the bursting of the thin glass bulbs. With a little different arrangement no difficulty would be experienced in carrying the experiments to a much higher point; but hitherto the greater interest attending the vacuum experiments has prevented me from working further in this direction. My friend and pupil, Mr. C. H. Gimingham, succeeded in the very difficult feat of sealing up some of these tubes under an internal pressure of 1½ atmosphere.

96. To carry this experiment a step further bulbs containing a suspended ivory or mica index were filled with carbonic acid gas, water, carbonic disulphide, ether, alcohol, and other liquids. The index in carbonic acid behaved as if it were in air of somewhat higher density than the atmosphere; movements were also obtained when the liquids were present, but they were so obviously due, in whole or in greater part, to currents, that they proved nothing of importance.

(To be continued.)

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 181.)

Chlorine, Bromine, Iodine, and Fluorine.

By Dr. E. Mylius, of Ludwigshafen.

The bromine lyes are kept in a large reservoir situate above the stills, in which they can be preliminarily heated by means of a coil of steam pipe. The height of the liquid is indicated by a float to which is attached a cord passing over a pulley and supporting at its other extremity a weight suspended in front of a scale, so that the workman in charging the stills is guided by the movements of this weight.

The stone lid is closed by its own weight, but may be further loaded with extra weights; the joints are made good with plastic clay. As we have already mentioned, the cover is raised by means of a counterpoise, but only when the apparatus is filled anew with manganese. The charge is about 4 cwts., which quantity serves for an entire series of operations. Not all qualities of manganese are fit for this purpose, that of medium hardness being the most suitable. The charges of bromine liquor and of sulphuric acid are introduced through one of the small apertures in the stone cover, which is immediately afterwards closed with balls of clay held down by iron weights. As soon as the apparatus is thus suitably secured steam is turned on and bromine vapours immediately escape in abundance through the leaden tube cemented into the second aperture in the cover. This leads to a worm surrounded with cold water in which the bromine is condensed. The original leaden worms have long ago been replaced by a stoneware apparatus.

At first the excellent but very costly stoneware worms of the English establishment "Lambeth Potteries," were used, but latterly German apparatus have been employed, especially those furnished by the firm of Jannasch, in Bernburg. The lower end of the stoneware worm opens by means of a bent glass adaptor into the central tubulure of a large three-necked Woolff's bottle holding about 8 litres, in which bromine and bromine-water collect. Into one of the lateral necks is fixed a movable glass syphon, by means of which the bromine-water can be drawn off into stoneware jugs. From the other neck a bent glass pipe passes down to the bottom of an iron vessel, which widens upwards in a conical shape and which is filled with water and iron turnings. Vapours of bromine which have not been condensed in the bottle are arrested by the iron. The impure chloriferous bromide of iron, as well as the bromine-water syphoned off are returned to the stills for the next operation.

At the beginning of the process scarcely anything but bromine is evolved, afterwards chloride of bromine escapes, and ultimately, when there is no more bromine in the apparatus, pure chlorine is evolved. Dr. Frank, for the instruction of the author, kindly caused an operation to be carried to the very end so that the three stages of the process, which are easily distinguished by the colour of the gas in the glass adaptor, were fully exhibited. In the ordinary routine of the works the operation is stopped when the chloride of bromine begins to be given off. The workmen in these establishments receive in addition to their wages a premium on the quantity of bromine obtained. Hence it is their interest to get through the greatest possible number of operations, and as the bromine lye is on hand in abundance they break off the operation as soon as the distillation of the bromine slackens. The quantity of sulphuric acid also is so calculated that it only just suffices for the liberation of the bromine in a charge. Hence the bromine obtained ought to be free from chlorine. It is found, however, in practice that, on account, doubtless, of the imperfect mixture of the reagents chloride of bromine is evolved even in the earlier stages of the distillation. The quantity of acid (hydrochloric acid?) must also be noticed which is given off towards the end of the process and produces such an evolution of hydrogen in the iron vessel that its contents froth strongly. In order to prevent loss by running over a broad saucer-shaped rim is cast on the iron at the distance of some centimetres from its upper margin in which the overflow collects and is conducted away by a side tube into a stoneware jug.

Each operation takes up about two hours and yields from 2 to 2·5 kilos. of bromine. The two bromine works at Stassfurt are so arranged that they are capable of producing 500 kilos. in twenty-four hours, but this quantity has never been actually furnished.

(To be continued).

* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzehends."

THALLENE: ITS SOURCE, AND THE HISTORY OF ITS DISCOVERY.

By HENRY MORTON, Ph.D.,
President of the Stevens Institute of Technology.

As the new hydrocarbon, thallene, which I succeeded in isolating and investigating in 1872-3, is now being produced on something approaching a commercial scale, though in a very impure state, some points in reference to its source, and the actual history of its discovery, may be of interest at this time.

Petroleum is ordinarily distilled from first to last in two stages.

In the first place, it is heated in large stills until all the lighter oils, consisting chiefly of benzin and the burning oils, are driven off, and there is then left a residuum or petroleum tar, of a density of about 20° B. This residue or tar is then transferred to other stills, in many cases run by other parties, and is again distilled for the production of lubricating oils and paraffin.

At the end of this operation, when the bottom of the still is already red-hot and some coke has been formed, there runs very slowly from the condensor a thick yellow-brown tar, which is almost solid in cold weather, and in summer

only semi-fluid. Much of it seems to lodge permanently in the heads of the stills, and my friend Prof. S. P. Langley, of Pittsburgh, once secured me a barrel of it by having the still-heads blown out with steam.

This thick tar, prior to 1873, was only used as a lubricant for the necks of rolls in rolling-mills, its great tenacity securing its adherence under the very unfavourable conditions to which it was there exposed.

About March, 1873, however, Mr. John Truax, of Pittsburgh, wrote me as follows, referring to this tar, a considerable quantity of which he had before sent me from his own works :—

"Within a few months we have found a new use for it in the manufacture of a lubricating oil, and we are trying in every direction to obtain it. When we shall have our new works in order—in the course of a couple of months —we can let you have as many specimens as you want."

It is this substance which contains thallene, and from which I extracted it. My attention was first drawn to it in the following way :—

In the early part of 1872 I was engaged in the systematic examination of various fluorescent bodies, and one day in February Prof. E. N. Horsford calling upon me, I showed him some of these, and he then mentioned that he had brought from Pittsburgh a highly fluorescent tar, which he would send to me.

Shortly afterwards about half an ounce of the yellow tar, enclosed in a bottle, was sent to me by Prof. Horsford from Cambridge. The bottle was broken in transit, and I presume that part of the contents escaped. There was, however, enough for me to examine so far as to show that a solid crystallisable hydrocarbon could be extracted from the yellow tar. For convenience of reference I called this "viridine," from its green colour and fluorescence, and made a preliminary note of it in a paper which I read before the American Institute in New York on March 29. Wishing to carry my investigations further, I wrote to Prof. Horsford for a further supply, and in answer received the following note :—

"New York, March 2, 1872.

"MY DEAR SIR,

"I am sorry the phial met with mishap. You might obtain more from Dr. Herbert C. Tweddle, Pittsburgh, I presume.

"The body that gives the fluorescence seems to me to reside in the yellow semi-fluid substance. You will occasionally see streaks of *green* in it. I hope it may be useful to you in your investigations.

"I am, very truly yours,
"E. A. HORSFORD."

On receipt of the above letter I wrote at once to Dr. Tweddle, describing the tar sent me by Prof. Horsford, and he then and subsequently promised to send me a quantity, but never did so. In the meantime, my friend Dr. G. F. Barker, then of New Haven, who had also brought some of the same tar from the works of Mr. John Truax, of Pittsburgh, hearing of my destitution, sent me part of his specimen to see if my new body was in it, and on my finding that it was he wrote to Mr. Truax to send me a large quantity. This Mr. Truax did promptly, and on my further advising him how to purify it he sent me some pounds of the new material, extracted from the tar as a dark olive-green solid mass.

It was with the material so received by me from Mr. Truax that I made my investigations, already published, which ended in establishing the individuality of a new hydrocarbon, resembling in many points anthracen, but fusing at 460° F., and forming compounds with chlorine, bromine, oxygen, picric acid, &c., entirely unlike the corresponding derivatives of anthracen.*

Not having facilities in my own laboratory at that time for such work, I was indebted to the kindness of my friend Dr. G. F. Barker, then of New Haven, for a combustion of this new substance, which indicated that it was probably isomeric with anthracen.

A specimen of the same material was kindly conveyed by my friend Dr. H. C. Bolton, to Dr. Tiemann, of Berlin, who made two combustions of it with the following result :—

I. 0·2821 grm. thallene gave 0·1430 H_2O = 5·63 p.c. H.
II. 0·2750 " " " 0·1412 H_2O = 5·70 p.c. H.
I. 0·2821 " " " 0·9622 CO_2 = 93·02 p.c. C.
II. 0·2750 " " " 0·9384 CO_2 = 93·06 p.c. C.

Anthracen requires—H, 5·62 ; C, 94·38.

However, I by no means consider that I have exhausted this subject, and hope to be able to give a rational formula for thallene before long.

Among the articles constituting the exhibit of the Stevens Institute of Technology in the Centennial Exhibition at Philadelphia are the following preparations and compounds of thallene :—

I. Crude thallene washed with benzin.
II. Crude thallene washed with benzin and hot alcohol.
III. Thallene purified by repeated crystallisations from benzol.
IV. Thallene as above re-crystallised from hot alcohol.
V. Thallene chinone.
VI. Thallene chloride.
VII. Thallene bromide.
VIII. Thallene picrate.
IX. Sublimed thallene.
X. Solarised thallene.

Within the last few weeks I have received from Dr. H. W. C. Tweddle (the same gentleman from whom I was *not* able to procure any material with which to carry out my investigations four years ago) a series of solid bodies, to which he has given a variety of names, but which seem to consist simply of thallene in a greater or less state of purity.

In the first place, under the name of petrozcene, he sends me a quantity of the product obtained by washing thallene-tar with benzin or petroleum naphtha. This was the first step of my process, published in 1872 (see CHEM. NEWS, vol. xxvi., p. 272), and, as might be expected, yields a product containing, it is true, some thallene, but contaminated with a large amount of uncrystallisable tarry matter and other impurities, which can be separated by washing with hot alcohol and repeated crystallisation from solution in hot benzol (coal-tar naphtha) in the manner described by me at first.

Together with the above, Dr. Tweddle sends me a series of products which he has obtained by distilling the same, and separating from time to time what passed over, as the temperature of the still rose.

The last but one of these products, which Dr. Tweddle finds to have a melting-point of 460° F., which was the melting-point found by me for thallene in 1872 (see CHEM. NEWS, vol. xxvi., p. 274), appears to be a tolerably pure specimen of thallene, yielding by two crystallisations from benzol a clear yellow substance characterised by the peculiar fluorescent spectrum and other physical properties by which this substance was first recognised. The other materials obtained at lower temperatures, prove to consist of thallene mixed with greater and greater amounts of the tarry substances and other matters which are removed by the process of crystallisation from hot benzol. Dr. Tweddle's last or highest product seems to be a mixture of thallene with carbon and other matters, the result of a partial decomposition caused by exposure to too high a temperature.

While it is interesting to find that by working on large quantities of a material a partial separation of thallene from other substances accompanying it may be effected, my observation of these products would not lead me to recommend it as a desirable method of obtaining pure thallene.

The best of the products sent me by Dr. Tweddle yielded

* See CHEM. NEWS, vol. xxvi., p. 272 ; *Monit Scient.*, vol. xv., p. 356 ; *Amer. Chem.*, vol. iii., p. 162 ; *Phil. Mag.* xlvi., p. 89 ; *Poggendorff's Annalen*, vol. clv., p. 551.

in benzol a dirtier and less pure solution than I obtained from the material supplied me by Mr. Truax when that had been well washed with benzin.

Dr. Tweddle's material, according to his own description, was also washed with benzin before it was distilled, so that nothing was saved here, and evidently a considerable amount of the thallene must have been decomposed in the process of distillation. To obtain anything like a pure product crystallisation from hot benzol must, moreover, be resorted to at last.

I have now on hand a large quantity of purified thallene extracted from a barrel of the tar which was secured for me by the kind exertions of my friend Prof. S. P. Langley, of the Allegheny Observatory, and with this I am conducting a thorough investigation of its chemical properties and derivatives.

NOTES OF WORK BY STUDENTS OF PRACTICAL CHEMISTRY IN THE LABORATORY OF THE UNIVERSITY OF VIRGINIA.

No. V.

Communicated by J. W. MALLET,
Professor of General and Applied Chemistry in the University.

(Concluded from p. 180.)

(5.) *Analysis of a Stove-Pipe Deposit.* By S. D. CRENSHAW, of Orange Co., Virginia.

In one of the working rooms of the Laboratory a "base-burning" stone, burning Pennsylvania anthracite and fed by gravity from a central hopper, is kept alight during the whole winter both by day and night. The stove-pipe, of common Russia sheet iron, rises about 12 feet vertically, and then runs horizontally about 24 feet before entering the chimney. When, in cold weather, the fire is burning slowly and draughts of cold air are allowed to enter the room from the doors, some of the products of combustion are condensed and come to the outside of the pipe at the joints, running slowly down the outside as a thick, orange-yellow, liquid mass in little streams of $\frac{1}{8}$ to $\frac{1}{4}$ inch wide. In the course of three or four days such a deposit hardens into an opaque mass of light brownish yellow colour.

Qualitative examination proved that this consisted essentially of ammonium sulphate and free sulphur, with small quantities of ferrous sulphate, free sulphuric acid, and a hydrocarbon apparently of one of the higher series. A portion of the material was completely oxidised and the total sulphur determined as barium sulphate; the amount of barium sulphate yielded by another (unoxidised) portion treated merely with water was also ascertained, and the difference gave the means of calculating the free sulphur. Ammonia was determined in the cold by Schlösing's method. It was ascertained that the iron was present altogether as a ferrous salt; it was then fully oxidised and determined as Fe_2O_3. The carbon and total hydrogen (there being also nitrogen and sulphur present) were determined by combustion with cupric oxide aided by a small amount of potassium chlorate, and the gases were passed over heated lead chromate and reduced copper turnings respectively. The oxygen of the water was obtained by difference. The results were:—

$(NH_4)_2SO_4$	80·48
$FeSO_4$	3·73
H_2SO_4	0·64
S	7·35
C	1·34
H comb. with C	0·11
Cl	trace
SiO_2	0·12
H_2O	6·23
	100·00

The deposition of free sulphur, doubtless as a result of the reducing action at a low temperature of the stove-pipe iron upon sulphur dioxide, is interesting; probably the reaction instead of $Fe_2+2SO_2=FeSO_4+FeS$, which occurs when the materials are more strongly heated, is $Fe+2SO_2=FeSO_4+S$.

(6.) *Analysis of the Ash of Hard Carbon Deposited in Coal-Gas Retorts.* By W. VAN SLOOTEN, of New Orleans, Louisiana.

The hard and heavy mass of carbon which encrusts the inside of a gas retort for some time in use, and which results from the decomposition of volatile hydrocarbons produced during the distillation, forms an admirable fuel for laboratory furnaces, in which a very high temperature is to be attained, this use having been first suggested by Violette (*Comptes Rendus*, October 28, 1872, p. 1028). Its value depends partly upon its high density, but chiefly upon the small quantity of ash which it leaves when burned, so that the intervals between the fragments of fuel do not become choked nor the draught of air obstructed. Mr. van Slooten undertook to determine the amount of ash in specimens of this carbon taken from a lot of several tons obtained from the gas works of Richmond, Virginia.

Small fragments of the material were burned in a stream of oxygen gas, supporting them on platinum foil in a hard glass tube. The combustion was not very easy to manage, since too slow a supply of oxygen readily led to the dense carbon ceasing to glow, while a little faster stream swept away the light particles of ash. It soon appeared that different layers of the deposit varied considerably in the amount of ash. Thus three specimens gave—

No. 1	1·66 per cent
No. 2	0·35 ,,
No. 3	0·95 ,,

while another sample, dull and earthy in appearance, from the gas works of Charlottesville, Va, gave—

No. 4	3·77 per cent

The ash from this last was analysed, it having proved excessively tedious to get enough of either of the others. The results were:—

SiO_2	42·00
Fe_2O_3	47·00
Na_2O	8·37
Li_2O	trace
Cl	3·72
	101·29
Deduct O equiv. to Cl ..	0·84
	100·45

The trace of lithium was detected by the spectroscope in the flame of the furnace.

The immunity from clinker or accumulation of ash in the furnace is seen to be due not always to the existence of a very small proportion of mineral matter in the fuel, but also to the very light condition in which this separates and is swept up the chimney with the draught. The occurrence in some cases of so considerable an amount of the not readily volatilisable elements silicon and iron in this retort carbon is not very easy to explain, and rather suggests the mechanical carrying forward of solid particles with even the comparatively gentle rush of combustible gas escaping from the coal.

(7.) *Production of Metallic Zinc free from Iron and Carbon, for Analytical Use.* By R. D. BOHANNON, of Mathews Co., Virginia.

On the whole, metallic zinc is the most convenient material for reducing ferric to ferrous sulphate in the often recurring volumetric determination of iron by potassium permanganate. For this purpose we must have the metal

perfectly free from iron and carbon, a condition in which it is almost impossible to procure it in commerce, even from the professed dealers in pure chemicals, while the purification by distilling out of contact of anything which can yield either of the elements to be removed is not an easy or convenient laboratory process. It is true that zinc containing iron might be used if the amount of the latter were certainly known, and known to be *uniform*, but this can scarcely be depended on. Mr. Bohannon has tried the production of the pure metal from the chloride (free from iron) by means of sodium, and with fairly satisfactory results.

Commercial zinc was dissolved in crude hydrochloric acid, the solution diluted, and sulphuretted hydrogen passed through to saturation. The clear liquid was filtered off from the precipitate of lead sulphide, &c., after standing for twenty-four hours, heated to the boiling-point, and treated with nitric acid enough to peroxidise all the iron present, which was then precipitated by the addition of ammonia until a portion of the zinc had been thrown down. After again standing for twenty-four hours, the solution was filtered off, evaporated to dryness, and the fused zinc chloride broken into small fragments. These were mixed with bits of metallic sodium and thrown into a previously heated and clean earthen crucible. The reaction was so violent that most of the zinc was volatilised and lost, but it was found that this could be prevented by previously diluting the fused zinc chloride either with sodium chloride or zinc oxide to a moderate extent. The metal obtained was quite free from iron (and of course from lead, copper, &c.) but afforded a trace of carbon derived from a little naphtha still adherent to the fragments of sodium used. This is easily prevented by careful drying of the larger pieces with a cloth, and then cutting off the outside crust. As regards the yield, 1·9 ozs. of pure zinc was obtained with an expenditure of 2·0 ozs. of sodium, but it was found necessary to have much more zinc chloride present (as a protective covering from the air) than the sodium was capable of reducing.

University of Virginia,
August 28, 1876.

NOTE ON DR. DAVY'S TEST FOR THE PURITY OF CHLOROFORM.

By DAVID B. DOTT.

In the Chemical News (vol. xxxiv., p. 137) appears an interesting and valuable paper on a "New Chemical Test for Alcohol," by Dr. E. W. Davy. In that contribution, however, there are some remarks of a misleading nature, which I think ought not to be allowed to pass without correction. The first statement to which I would take exception is the following:—"As regards chloroform, one of its common impurities is ethylic alcohol, which it may contain either from imperfect preparation or from fraudulent addition, the very high price of chloroform offering a great temptation to the unscrupulous vendor to increase its bulk or weight by the addition of alcohol." Now, it is manifest that as the specific gravity of pure chloroform is at least 1·500, while the British Pharmacopœia gives 1·490 as its standard specific gravity, the official chloroform must of necessity contain alcohol. It is therefore altogether erroneous to assert that the alcohol is present either "through imperfect preparation or fraudulent addition," the real reason for its addition being the prevention of decomposition in the chloroform. It appears that this new test can detect the presence of 1 part of spirit in 1000 parts of chloroform; but as the addition of 1 part of spirit to 2000 parts of chloroform reduces the gravity by about 0·001, the specific gravity would seem to be a more delicate test of the presence of alcohol than is molybdic acid. Dr. Davy informs us that "he was unable to obtain any sample of chloroform in commerce sufficiently pure not to give a blue reaction with the molybdic test, owing to the minute quantities of volatile oils and other impurities they contain." I think I shall be able to show that this blue reaction is due simply to the presence of alcohol, and not to volatile oils or similar impurities. In the first place, I examined a sample of the ordinary unreduced chloroform prepared from ethylic alcohol by Messrs. J. F. Macfarlan and Co., and found that it gave *no trace* of blue coloration with the molybdic test, while the reduced chloroform (sp. gr. 1·496) gave the characteristic alcohol reaction at once. I next procured some of the volatile oil obtained in the purification of chloroform, and treated it repeatedly with solution of calcic chloride, to remove the alcohol. When a drop of this oil was added to the molybdic solution a pinkish tint was developed, but *no blue coloration*. I then mixed a drop of the purified oil with 1 drachm of pure chloroform, and submitted the badly-smelling mixture to the molybdic test, with the result that *no colour whatever was produced*.

I trust that I have said sufficient to prove that Dr. Davy's strictures on the character of commercial chloroform are unwarranted, and that the impurity he has discovered is simply alcohol, which is not an impurity in the correct sense of the word.

93, Abbey Hill, Edinburgh.

ON ANTHRACENE TESTING.

By DR. FREDERICK VERSMANN.

(Continued from page 179).

I am fully aware of the objections likely to be raised to my test. It will be said some confusion will arise in consequence, because the standard of valuation will be changed, inasmuch as my test will always indicate a lower percentage than the one now in use. My answer is—My test is more correct and more trustworthy; and at all events the buyers of anthracene are fully aware that the present quinone test does not give them the true value of the article, but only an indication, which they supplement themselves by further analysis.

The history of anthracene testing has been gradually progressive, from the alcohol to the bisulphide of carbon, and thence to the quinone test. Each of these modifications reduced the percentage, and was accompanied by an increase in the price of per cent, and if my test should be adopted the enhanced value of per cent will soon be regulated and find its level.

In looking at the first table it will be noticed that although the results found by the usual test range from 11·4 to 68·5 per cent, and that of the crystals from 6·6 to 63·2 per cent, the percentage of the powder fluctuates within very narrow limits. Omitting Nos. 2, 12, 28 on the one hand, and Nos. 9, 12, 26 on the other hand, the remaining 24 samples yield between 4 and 6 per cent of powder.

I have been very particular, as far as possible, to learn the history of all these samples, and I can fully account for the exceptionally low and high percentage in powder of the six samples; hence I am justified in neglecting them in the following considerations:—

The observation that a sample of the lowest quality yields nearly as much powder as another of the best quality, which last shows six times the amount of quinone by the usual test, is a strong confirmation of the well-known practical experience that the low per cent article is always of less comparative value than a better quality article.

Although this fact is well understood, it is but little acted upon, or the many low-quality lots would long have disappeared from the market. I think if the manufacturer can be clearly shown that a better quality article is more profitable he will after all improve his make, and as the buyers will take it all the more readily, I shall be

well satisfied if my experiments should in some degree contribute to an improved manufacture, the whole of which is, after all, in a very primitive state. It will then be interesting to prove the difference in value by actual experiment, and with that object the following results were obtained :—

There are two methods of improving the quality of anthracene, viz., by simple strong pressure, and by washing with suitable solvents of a number of impurities. As much oil as ever possible should be separated by pressure, because the oil retains much of the impurities which afterward yield the powder instead of quinone crystals; and, further, if an oily sample is washed at once much anthracene is lost by solution. Two very oily and poor samples were therefore first strongly pressed, the first once and the second twice, with the following result, viz. :—

Effect of Pressing Two Samples of Anthracene.

	Crystals and Powder Mixed.		Crystals.		Powder.	
1. Original	11·4	283 275—279 277	6·6	278 272—275 277	4·8	not at 300
Once pressed	20·6	273—275	17·8	275—276	2·6	not at 300
2. Original	15·2	276 274—275 277	10·2	278 274—276 281	4·6	280 270—275 276
Once pressed	22·0	273—275 280	18·3	273—277 280	4·0	262—269 271
Twice pressed	26·4	274—277	22·1	276—278	4·2	261—266

300 grms. were taken in each experiment, which with the first sample were by once pressing reduced to 150 grms., while in the second series the 300 grms. were by twice pressing reduced to 192 and 160 grms. respectively. By multiplying these quantities with their percentages we obtain the following table of total per cent units, which are also reduced to 1000 :—

alkaline filtrate remains of a deep orange colour, even after very prolonged washing with hot alkaline solution.

It will be unnecessary to further summarise the result of the above tables because it is very evident that the reduction in percentage formed by the usual quinone test is an apparent loss only, for the crystals alone show a sensible increase, and the powder a remarkable diminution.

Now to the second method of improving the quality of anthracene, viz., by washing, I have taken two samples of very different percentages, and have purified them in a similar manner as is usual on the large scale; the first table on next page gives the results.

1000 grms. of anthracene were taken in each experiment, and the quantities obtained were as follows :—

No. 1. First treatment	440 grms.
Second treatment	190 ,,
No. 2. First treatment	720 ,,
Second treatment	510 ,,

By multiplying these quantities with their respective percentages we obtain the following table of total per cent

		Crystals and Powder Mixed.	Crystals.	Powder.
1. Original	300	11·4 = 3420 or 1000	6·6 = 1980 or 1000	4·8 = 1440 or 1000
Once pressed	150	20·6 = 3090 or 903	17·8 = 2670 or 1348	2·6 = 390 or 271
2. Original	300	15·2 = 4560 or 1000	10·2 = 3060 or 1000	4·6 = 1380 or 1000
Once pressed	192	22·0 = 4224 or 925	18·3 = 3513 or 1170	4·0 = 576 or 417
Twice pressed	160	26·4 = 4224 or 925	22·1 = 3536 or 1173	4·2 = 672 or 487

Taking in all cases the percentage of "crystals and powder mixed" as 100, and calculating therefrom the proportion of crystals and of powder separately, we obtain the following table, which will show more clearly the effect of pressing :—

	Crystals and Powder Mixed.	Crystals.	Powder.
1. Original	100	57·9	42·1
Once pressed	100	86·4	12·6
2. Original	100	67·1	30·2
Once pressed	100	83·2	18·2
Twice pressed ..	100	83·3	15·9

Taking the crystals as pure quinone and the powder as impurity, retaining very little quinone, the effect of pressing is very striking, and it becomes pretty evident that no article giving less than 20 per cent of crystals should be found in the market.

The action of potassium permanganate and especially of potassium hydrate, points in the same direction, *i.e.*, the lower the percentage of a sample the more oily and impure the sample the larger the proportion of impurities removed, and this is sometimes to such extent that the units, which are also reduced to 1000. (See second table on next page).

Taking in all cases the percentage of the mixture of crystals and powder = 100, we obtain the following table, which will show more clearly still the effect of purifying :—

	Crystals and Powder Mixed.	Crystals.	Powder.
1. Original	100	55·0	43·3
First treatment ..	100	77·0	22·6
Second treatment ..	100	91·2	8·9
2. Original	100	86·2	13·2
First treatment ..	100	91·8	7·9
Second treatment ..	100	95·9	4·6

These tables again show the different effect upon the mixture of crystals and powder, and upon the crystals and powder separately, and, as I think, give a clear idea of the real working effect of the various treatments, such as has hitherto not been collected or published. I also think the above results will tend to prove the practical value of separating the crystals and powder, instead of merely estimating the mixture.

Some experiments made with the view of learning more

Effect of Purifying two Samples of Anthracene by two Consecutive Treatments.

	Crystals and Powder Mixed.		Crystals.		Powder.	
1. Original	17·8	270 266—268	9·8	277 273—275	7·7	not at 300
First treatment	27·0	277 273—275	20·8	278 274—276	6·1	270 260—265
Second treatment	52·5	280 272—276	47·9	280 274—277	4·7	not at 300
2. Original	34·8	278 268—273	30·0	278 276—277	4·6	not at 300
First treatment	41·7	278 276—277	38·3	278 276—277	3·3	276 264—270
Second treatment	56·3	279 275—277	53·9	280 274—277	2·6	not at 300

	Crystals and Powder Mixed.	Crystals.	Powder.
No. 1 1000	17·8 = 17800 or 1000	9·8 = 9800 or 1000	7·7 = 7700 or 1000
First treatment .. 440	27·0 = 11880 or 667	20·8 = 9152 or 934	6·1 = 3124 or 406
Second treatment .. 190	52·5 = 9975 or 560	47·9 = 9101 or 929	4·7 = 893 or 116
No. 2 1000	34·8 = 34800 or 1000	30·0 = 30000 or 1000	4·6 = 4600 or 1000
First treatment .. 720	41·7 = 30024 or 863	38·3 = 27576 or 919	3·3 = 2376 or 515
Second treatment .. 510	56·3 = 28713 or 831	53·9 = 27489 or 916	2·6 = 1326 or 287

closely the nature of the powder may find their place here, although, as I have already stated, I have not yet come to a final conclusion on this point.

(To be continued.)

ON A NEW NICKEL MINERAL FROM NEW CALEDONIA.

By P. G. W. TYPKE, F.C.S.

MR. A. LIVERSIDGE, Professor of Mineralogy, Sidney University, New South Wales, described, in 1874, in the *Journal of the Chemical Society* (New Series, vol. xii., p. 613) a new nickel mineral which he had obtained from New Caledonia, and to which he assigned the formula—

$$(NiO,MgO)_{10}(SiO_2)_8+3H_2O, \quad \text{or,}$$
$$\left.\begin{matrix}Ni\\Mg\end{matrix}\right\}_{10} Si_8O_{26}+3H_2O,$$

showing it to be principally a hydrated double silicate of nickel and magnesia.

Through the kindness of Mr. T. Loram, F.C.S., Mr. Valentin received a splendid specimen of the new nickel ore which had come into the London market, and at his instigation I submitted the ore to a fresh investigation. As the results which I obtained differ in many respects from those obtained by Professor Liversidge, I thought you might perhaps think them of sufficient interest to publish them in your valuable journal.

A glance at the ore showed that its composition was not uniform. The greater portion consisted of an emerald green, brittle substance, which could be easily scratched with the knife, and exhibited, when broken up, an uneven fracture.

This green mineral was coated in places where the water had acted upon it with a brown powdery substance, and exhibited layers or thin greenish white strata of disintegrated portions of the mineral, containing quartz crystals. Other portions of the ore showed dark brown to black with the lustre and appearance of radiated heavy spar, and contained much ferric hydrate.

A qualitative analysis of the several portions of the ore—the apple-green and the dark brown—showed that the latter differed from the former in containing more ferric hydrate and a little more alumina. Both contained principally silicic acid and nickel oxide, with little ferric oxide and alumina, and less even of lime and magnesia. The green portion contained mere traces of ferric oxide and alumina, also mere traces only of lime and magnesia. The different portions of the ore were specially tested for carbonate, but traces only were found in each case, largest in the brown substance.

The hard and greenish white portion constituting the layers or strata already referred to, and resembling magnesic silicate, contained principally insoluble silica (quartz) with small quantities of the constituents of the soft green and brown parts of the mineral.

I more especially examined the green mineral, as the qualitative analysis had shown that it formed the more important constituent of the ore. It was amorphous and of uneven fracture. Its colour was of a bright apple-green to olive-green; streak light green; hardness about 3; sp. gr. = 2·468; lustre dull vitreous; heated in a closed tube it gave off water and darkened in colour; heated before the blowpipe flame it left a brown magnetic powder, and on platinum wire with borax gave the ordinary nickel bead.

Quantitative Analysis.

Determination of Water.—A carefully selected portion of the bright apple-green mineral was powdered in the agate mortar and dried at 100° C.

1. 4·8110 grms. lost 0·2120 grm. .. = 4·40 p. c. of OH_2
2. 0·6520 grm. of the mineral dried at 100° C. when ignited in a platinum crucible lost 0·0490 grm. .. = 7·51 „ „

Total percentage of loss.. .. .. = 11·91 „ „

The analysis of the other constituents was made with the portion of the mineral dried at 100° C.

Determination of Silica.—The substance was dissolved in dilute hydrochloric acid. The greater portion of the silica being left in the insoluble state (quartz), the whole was evaporated to dryness and ignited.

1. 1·4280 grm. of (dry) substance gave 0·7946 grm. of SiO_2 .. .. = 55·64 p. c. of silica
2. 0·8475 grm. of (dry) substance gave 0·4760 grm. of SiO_2 .. .. = 56·16 „ „

Determination of Ferric Oxide and Alumina.—

1. 1·4280 grm. gave 0·0136 grm. of Fe_2O_3 and Al_2O_3 .. .. = 0·95 p. c.
2. 0·8475 grm. gave 0·0060 grm. of Fe_2O_3 and Al_2O_3 .. .. = 0·70 „

No separation of the iron and alumina was attempted.

Determination of Nickel Oxide.—

1. 1·4280 grm. gave 0·5078 grm. .. = 35·56 p. c. of NiO
2. 0·8475 ,, 0·3015 ,, .. = 35·57 ,, ,,

The nickel oxide when dissolved in hydrochloric acid and re-precipitated with KHO showed no diminution in weight.

Determination of Magnesia.

1. Experiment lost.
2. 0·8475 grm. gave 0·005 of $P_2O_7Mg_2$ = 0·18 p. c. of MgO

Mr. Liversidge ignited his mineral till "it ceased to diminish in weight," but does not appear to have observed that after ignition the nickel was no longer soluble either in hydrochloric acid or in *aqua regia*, whilst before ignition it dissolved freely in dilute hydrochloric acid, leaving insoluble white granular silica behind. The nickel silicate of the mineral being in the hydrated condition is converted by strong ignition in a platinum crucible into the *insoluble* anhydrous silicate.

In order to ascertain whether nickel existed as hydrate in the mineral I boiled up a portion with ammonic carbonate, filtered, and passed sulphuretted hydrogen through the filtrate. No nickel sulphide was obtained, showing that the whole of the nickel was combined with the silica.

	Percentage composition of the Mineral dried at 100° C.		
	I.	II.	Mean.
Water lost on ignition	7·51	—	7·510
Silica	55·64	56·16	55·900
Nickel oxide	35·56	35·57	35·565
Alumina and ferric oxide ..	0·95	0·70	0·825
Lime	mere traces		
Magnesia	—	0·18	0·180
			99·980

Water of hydration lost at 100° C. = 4·40 p. c.

From these figures the composition to be deduced for the apple-green nickel mineral is approximately that of a hydrated nickel disilicate of the formula :—

$$Si_2O_6NiH_2, \text{ or, } \begin{cases} SiOHo \\ Nio'' \\ SiOHo \end{cases}$$

Another portion of the apple-green mineral picked from a different part of the ore yielded results which differed considerably from the figures obtained with the mineral just described. Unfortunately the determination of the nickel oxide was lost, and I was therefore unable to complete the analysis. Thus much, however, it would appear, may safely be deduced from the subjoined figures, that the proportions of silica and nickel oxide, as well as water of hydration, vary to some extent in the apple-green mineral.

	Composition in 100 parts of the dried (100° C.) Mineral.
Water lost on ignition of the substance (dried at 100° C.) ..	6·55
Silica	66·07
Nickel oxide	lost
Alumina and ferric oxide	0·18
Lime	trace
Magnesia	trace

A portion, 0·473 grm., of the mineral was boiled with pure sodic carbonate in a platinum dish, and the filtrate evaporated to dryness with hydrochloric acid, when it left 0·0225 of silica = 4·33 per cent of uncombined silica.

There is a considerable range left between Mr. Liversidge's 47·236 per cent of silica and my 66·97, or even 55·90 per cent of silica, as found in the two samples picked and selected with equal care; and we can therefore only come to one conclusion, viz., that the mineral is probably the result of the action of hydrated or soluble silicic acid upon some nickel compound, and that the proportions of silicic and nickel oxide vary, and do not justify us in fixing upon a mineralogical formula, or making out a distinct species of a nickel mineral.

Royal College of Chemistry,
October 16, 1876.

ESTIMATION OF BARLEY IN OATMEAL.

By Messrs. PATTINSON and STEAD,
Analytical Chemists, Middlesborough-on-Tees.

As the practice of adulterating oatmeal with the less valuable barley-meal is much resorted to by millers and others, it becomes, of the greatest importance to have some systematic method of analysis by which to determine the proportion of barley so introduced. We therefore beg to lay before your readers the following methods, practised by ourselves, which we find to give very good results.

In order to obtain an average sample from the parcel of meal received for analysis, the whole contents of the parcel are thoroughly mixed in a large porcelain mortar. A quarter of the meal mixed in this manner is now pounded to twice its original fineness, which is then spread evenly over the surface of a piece of paper. When this is done, 10 grms. (taken over the whole of the meal) are weighed off, pounded, and passed through a brass sieve containing thirty meshes to the linear inch. In order to expedite the pounding, which is a tedious process, after each pounding the oatmeal is transferred to the sieve, and is there rubbed with an india-rubber pestle, which has the effect of causing the fine meal to separate from the epidermis, to which it adheres very pertinaciously, and thus makes it difficult to pound. After the whole has passed through the sieve it is very well mixed up, and about 2 grms. placed in a 3-inch glass or porcelain mortar with sufficient milk-warm water to make a moderately thin paste. The mortar and contents are kept slightly warm during the pounding in order that the cellular matter may be softened, and the starch thus made easy to separate. The pestle is kept gently working for about five minutes, care being taken not to press too hard, for if too much pressure is applied the barley starch granules will be broken up. We find that the weight of the pestle itself is quite sufficient for the purpose. The sample after this treatment is ready for mounting. A small quantity of the paste is taken on the end of a glass rod, and is transferred to the slide of a microscope. A drop of water is allowed to fall on the paste, and a thin glass cover placed over the whole. Pressure is now applied to the cover, which is at the same time rubbed backward and forward. The excess of the substance in water is removed from time to time by means of blotting-paper.

The pressing and rubbing actions are continued till the outline of surrounding bodies can just be observed with the naked eye with an equal degree of distinctness through every part of the slide covered by the object. Great care is taken not to allow too much water to be under the cover, for when an excess of water is present the starch grains run together into groups, which at once renders the object useless. The slide prepared, it is now examined under the microscope, and the barley granules, in ten different fields, counted. Standard samples are now examined, one containing 5 and the other 10 per cent barley. These we always have ready for mounting. They are prepared by mixing 9·5 grms. and 9 grms. of pure oatmeal with 0·5 and 1 grm. barley respectively, and treating the mixtures in all respects as detailed above.

If the sampling and mounting has been properly executed, the number of barley granules found in ten different fields of the 10 per cent sample slide will be twice the number found in ten similar fields of the 5 per cent sample. This having been obtained, we have now only to calculate from the results obtained.

First divide the number of granules found in the 5 and 10 per cent standard slides by 5 and 10 respectively; this gives the number of barley grains corresponding to 1 per cent of barley. We have now only to divide the number of granules found in the sample slide by the figure obtained as above mentioned to arrive at the percentage of barley present.

We should here state that we always mount two slides, and take the average of the two results.

The following are the results obtained by testing mixtures of oat- and barley-meal, the composition of which was known, viz.:—

Barley Present in Oatmeal.	Granules in Ten Fields.	Barley Found.
1 per cent	8·0	1·00 per cent.
2 ,,	16·5	2·06 ,,
3 ,,	23·5	2·93 ,,
4 ,,	33·5	4·19 ,,
5 ,,	40·0	5·00 ,,
10 ,,	80·0	10·00 ,,
20 ,,	163·0	20·30 ,,
30 ,,	248·0	31·00 ,,

The great objection to microscope analysis has been due, first, to the great difficulty of obtaining a fair average sample in the minute amount mounted on the slide. Second, to the still greater difficulty of getting the same proportion of meal on comparative slides. It will be clear that the number of granules must depend on the amount of meal in any given area, and that unless the proportions are the same good results would be impossible. We, however, find that by the method of mixing with warm water, and stirring for a considerable time, a very thorough mixing is ensured, inasmuch that portions taken from different parts of the mixture when examined under the microscope give very concordant results. Also, that by making the comparative slides have an equal degree of transparency through those parts over which the meals are spread, the difficulty of obtaining similar amounts of meal on different sildes is overcome, as we find that when the transparency is equal the amount of meal is also equal.

Second Method.

This method is based on the great differences in appearance and hardness of coarsely ground oat- and barley-meal. We proceed as follows, viz.:—After thoroughly mixing the sample, we sieve off the finer parts of the meal, and examine only the coarse portions, as we find that, as a rule, the coarse portions contain the same proportion of barley as the fine. 3 or 4 grms. are spread out on the surface of a piece of glazed paper, and with the aid of a pocket-lens and by pressing with the finger-nail, the harder barley particles are detected, and may be completely separated from the oats. It is only necessary to weigh the barley so obtained to arrive at the proportions in which it exists in the sample.

This is a very excellent method, and is always used by us in conjunction with the microscope method, with which it agrees very closely. It is best, however, not to depend on this method alone, as the sellers of oatmeal might take the precaution to mix what they sold with finely-ground barley, in which case the whole of the barley would pass off with the fine portion when being sieved, and more would therefore be found in the coarser part,

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Sheep Husbandry in Georgia.—"A Manual of Sheep Husbandry in Georgia" has been prepared under the direction of the Commissioner of Agriculture of the State of Georgia. From it we learn that sheep-raising is more lucrative than cotton-growing, the average annual profit on capital invested in sheep being 63 per cent. The great drawback lies in the useless dogs with which we believe the United States are more infested than any other part of the world, and which in Georgia destroy 28,000 sheep yearly!

CORRESPONDENCE.

DYSODILE.

To the Editor of the Chemical News.

SIR,—I think you will find in Prof. Church's article on dysodile a mistake. In giving the results of his analysis he says—

"0·328 grm. gave 0·098 grm. Fe_2O_3, or 28·88 p.c. Fe_2O_3."

I think Prof. Church will find, if he will re-calculate the above data, that the percentage of Fe_2O_3 will be 29·87, or that, correctly stated, the above would be—

"0·328 grm. gave 0·098 grm. Fe_2O_3, or 29·87 p.c. Fe_2O_3."

—I am, &c.,

R. P. DAVIES.

Littleborough, October 30, 1876.

ORGANIC AND MINERAL PHOSPHATES IN MANURES.

To the Editor of the Chemical News.

SIR,—In the CHEMICAL NEWS (vol. xxxiv., p. 154) you were good enough to insert a query for me asking for information respecting the estimation of mineral and organic phosphates in mixed manures. I had some slight hope of an answer, for I hear that there is an agricultural chemist who professes to do this. Perhaps, sir, by the insertion of this letter in your valuable journal we may derive information respecting the metnod of estimation, and test its accuracy.—I am, &c.,

E. CHRIS. POTTER.

3. Romney Terrace, Greenwich, S.E.,
October 28, 1876.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Moniteur Scientifique, du Dr. Quesneville, October, 1876.

Chemical Force of Light.—An abstract of a work on this subject, recently published by M. E. Marchand. The chemical action of light is studied especially from a climatological point of view.

Spectrum Analysis.—A notice of Prof. Bunsen's recent paper inserted in *Poggendorff's Annalen*, vol. clv.

Theory of Spectral Rays.—M. G. Salet finds that many chemical elements, especially the non-metallic, have two spectra—one formed of lines, which is due to atoms, and one with bands, which pertain to molecules. Iodine in the state of vapour at the ordinary pressure gives an absorption-spectrum composed of channelled bands of the beautiful colour peculiar to this element, and which cannot be due to an unknown compound of iodine. But if an electric spark of high tension is caused to strike through the vapour there is obtained a totally different spectrum, composed of brilliant rays, the arrangement of which stands in no relation with that of the absorption-bands, and which do not coincide with those of any other known element. From analogous reasons M. Salet considers that it must be admitted that bromine, sulphur, &c., have each two distinct spectra. A spectrum with bands is also obtained with nitrogen, however it has been purified. The vapours of the alkaline metals yield also by absorption spectra quite similar to those of the non-metallic elements. The multiplicity of spectra appears, therefore, a general fact. The band-spectra, due to complex molecules, appear at temperatures where certain atomic groupings may still exist. The line-spectra appear when a very elevated temperature has disaggregated these combinations, and forced the atoms to arrange themselves in a more simple manner. It is to some extent a spectral allotropy.

Observations on the Last Work of M. Pasteur on the Fermentation and Manufacture of Beer.—M. Charles Blondeau.—A lengthy dissertation, unfit for abstraction.

Historical and Chemical Survey of the Manufacture of Turkey-Red.—M. Theodor Chateau.—The conclusion of this treatise. The author in summing-up gives the following as his theory of the process of Turkey-red dyeing:—The oil employed brings with it a fatty acid, the oleic acid, or gives rise to the same or to a similar fatty acid, or to a mixture of fatty acids in which oleic acid predominates. In the process of aluming this fatty acid, simple or compound, combines with a certain quantity of alumina set at liberty in the operation, forming a fatty salt with an aluminous base, which may also be formed by double decomposition between alkaline fatty salts and salts of alumina. This fatty acid at the same time forms a kind of combination with albuminoid matter, whether the sort of vegetable albumen found in the emulsive oils (*huiles tournantes*), or with the animal albuminoid matters of yolk of egg, blood, gall, when these are employed, or with those of the dung of cows, sheep, or goats. This threefold compound of fatty acid, alumina, and albuminoid matter has not the stability of a definite compound, for neutral liquids like aceton, oils of turpentine and petroleum, and sulphide of carbon split it up, or rather divide it into several parts, some soluble in these media, and the others insoluble or merely viscid. This triple compound does not combine intimately with the fibre of the cotton, since the above-mentioned neutral solvents remove it, proving that it is merely deposited on the surface, or at any rate penetrates but to a small depth, a fact which constitutes one of the physical characters of the brightness of Turkey-red. This triple compound unites, or rather is dyed, on contact with the colouring matter of madder without forming any intimate combination with the fibre of the cotton, such as takes place in the operations of dyeing upon tissues prepared with ordinary mordants. The lake thus formed on the outer surface of the cotton may be brightened by the ordinary methods of "clearing."

Manufacture of Ultramarine.—C. Furstenau.—Only two silicates of alumina are serviceable in the manufacture of ultramarine, $2Al_2O_3,3SiO_3$ and $Al_2O_3,2SiO_3$. These silicates yield colours having different properties according as they are treated with the bisulphide or pentasulphide of sodium, thus:—(1.) $2Al_2O_3,3SiO_3$ treated with NaS_2 give a light blue product of feeble colouring power. (2.) $2Al_2O_3,3SiO_3$ with NaS_5 gives a pure deep blue of great colouring power. These two colours do not contain alum. (3.) $Al_2O_3,2SiO_3$ treated with NaS_2 gives a reddish light product not very pure. (4.) $Al_2O_3,2SiO_3$ treated with NaS_5 gives a deep violet-blue of great colouring power. China clays in which the alumina and silica are found in other proportions than those indicated above give mixtures of different ultramarines. For a pure blue the following mixture may be taken:—

$$2Al_2O_3,3SiO_3+4NaO,CO_2+4C+7S.$$

For reddish products of great colouring power—

$$Al_2O_3,2SiO_3+4NaO,CO_2+8C16S.$$

Salicylic Acid and its Applications.—Dr. F. von Heyden.—A very long paper, not suitable for abstraction.

Certain Derivatives of Dimethyl-Protocatechuic Acid and of Vanillic Acid.—MM. F. Tiemann and Kaeta Oukimori Matsmoto.—Taken from the *Ber. der Deut. Chem. Gesellschaft.* The authors have given vanillic acid the more formidable name of mono-methyl-proto-catechuic acid.

Coniferyl and Vanillin.—F. Tiemann.

Sulphur in Lighting-Gas.—M. A. Vérigo.—Already noticed.

Litigation on the Use of Aniline-Black in America.—The action brought by M. J. J. Müller Pack, purchaser of the patent-rights of the late Mr. J. Lightfoot, against the Merrimack Manufacturing Company has been decided in his favour.

MISCELLANEOUS.

The Research Fund of the Chemical Society.—A sum of £1000 has been voted to the Chemical Society by the Goldsmith's Company, in aid of the fund for the promotion of original research.

New Scholarship in Chemistry at Owens College.—The sum of £700 has been presented to Owens College, Manchester, by Mrs. Crace Calvert, for the foundation of a Scholarship in Chemistry of the annual value of £25, in memory of her late husband, Dr. Crace Calvert, F.R.S.

Lead Poisoning.—In a late number of *The Lancet* a somewhat singular case of cumulative lead-poisoning is reported, which tends to show that early rising has its pains and penalties as well as its profits and pleasures. A cab-washer who was in the habit of drinking deeply during the day, and of sleeping in an omnibus until the time came for him to wash forty cabs, was brought into St. Mary's Hospital, in February, 1875, suffering from phthisis and delirium tremens. He recovered from the latter complaint and got better of the former, but it was found that he had completely lost the use of his upper extremities, while his voice was reduced to the merest whisper. On being questioned he stated that, as he usually finished his work just as the public-houses opened, he always had the very first glass of beer or gin that was served in the morning; that is to say, the liquor which had remained all night in the drawpipe in contact with the lead. His gums showed the well-known blue line indicative of lead poisoning, and other confirmatory symptoms existed which need not be detailed here. His urine gave 1-3400th of a grain of lead per fluid ounce, and some of the gin which he drank every morning having been procured and tested gave 1-430th of a grain per fluid ounce. From the beginning of June to the beginning of December he was treated with iodide of potassium in large doses, and was galvanised and faradised daily, but all to no purpose. Mr. S. J. Knott, M.R.C.S., the medical superintendent of galvanism at St. Mary's Hospital, suggested that a thorough trial of galvanic baths should be made on the patient. Accordingly, on December 4th, he was placed in a warm bath, and the water charged with twenty-eight cells of a voltaic battery. At first the current was passed from the positive pole, placed at the nape of the neck, to the negative, which was placed at the feet. After ten minutes the negative pole was moved along his legs and arms for twenty minutes more. The treatment was continued daily, and at the end of a fortnight he was so much better as to be able to raise his arms fairly, and flex them pretty well. From this time he continued to mend, the baths being still kept up three times a week, and finally returned to his work in February. The fourth bath was acidulated and tested by Dr. Handfield Jones, who found well-marked traces of lead in it, which were absent in the water supplied to the bath. If lead can be thus eliminated from the body by the electric current, why not arsenic, mercury, and silver? In ordinary cases of lead colic and dropped wrists the electric bath has proved efficacious in a few days without any medicine. If this method of administering electricity be equally efficacious in other cases of plumbism as in those treated by Mr. Knott, medicine will have to thank physical science for putting into her hands an additional weapon for counteracting human disorders.

TO CORRESPONDENTS.

W. Wallace.—The tables will be inserted in an early number.

J. B. Lindsay.—Reece's machine is a good one.

ERRATUM.—On page 185, col. 1, line 30 from top, *for* "2000 grammes" *read* 2000 grains.

THE CHEMICAL NEWS.

Vol. XXXIV. No. 885.

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 188.)

Chlorine, Bromine, Iodine, and Fluorine.

By Dr. E. Mylius, of Ludwigshafen.

The arrangements for the ventilation of the bromine works are peculiarly interesting. The critical moment is when the manganese liquid is run out of the stone tanks, since it throws off vapours of chlorine and bromine in abundance. Yet the operation is performed without the least inconvenience to the workman. Along the series of stills there runs a channel of brickwork, through which a powerful current of air is drawn by the great chimney of the works in a direction opposite to that in which the liquid runs off. The channel is situated so that the vent holes of the stills open into it. In front of every still there is introduced in the roof of the channel a damper which is opened when the plug of the vent hole is about to be knocked out. The draught is so powerful that the workmen are not in the slightest degree incommoded by the vapours evolved from the stream of solution of manganese. The workshops smell distinctly of bromine, but the odour is far fainter than that which is experienced in our scientific laboratories during the bromation of organic substances.

As has been already remarked, crude bromine always contains a little chlorine, even when, according to the Stassfurt practice, the Woolf bottle is allowed to become slightly warm towards the end of the operation, so as to drive the volatile chloride of bromine over into the iron-turnings. A rectification is therefore requisite. This takes place in glass retorts containing about 15 litres, the necks being cemented into receivers bedded in cold water. Each retort is set in a separate sand-bath, so that if one happens to burst—and such misfortunes cannot be avoided—the injury may be limited as much as possible. Only a slight aqueous fraction contains chlorine; it is withdrawn and returned to the stone stills. The rectification lasts about twenty-four hours. The atmosphere in the rectifying-house is more offensive than that in the still-houses, since all currents of air must be carefully avoided. The workmen, however, require to enter this room from time to time. Moreover there are especial arrangements which render it possible to decant the bromine both out of the Woolf's bottles into the retorts, and from the receivers into the vessels used for transport without any annoyance from the vapours abundantly evolved during these operations. The decantation is performed in wooden chests, through which a violent current of air is drawn by the great chimney. The workmen soon acquire such dexterity and accuracy in these manipulations that they are content to cover the respiratory organs with a wet cloth, and disdain to make use of the ventilating arrangements placed at their disposal.

(At Stassfurt bromine is sent off in strong glass bottles holding 2·5 kilos. The well-ground stoppers are sealed with shellac, luted with clay, and tied up with parchment paper. Four or twelve such bottles are packed in a chest. —A. W. H.)

Iodine.—The rapid extension in the demand of the splendid violet, blue, and green coal-tar colours, which are prepared by means of the iodides of the hydrocarbons has in the last few years occasioned a notable increase in the consumption of iodine. The production, from very simple reasons, could not keep pace with the growing consumption, which of course led to a considerable increase in the commercial value of a body relatively of such rare occurrence in nature. Its price has been further increased by the circumstance that the seaweed ashes of England and France (Kelp, Varec) have become less remunerative to the producers. Formerly these weed ashes served to supply a considerable part of the demand for the salts of potash, but since the utilisation of the well-known "Abraum salts" of Stassfurt the extraction of potash salts from seaweed ashes has become so unremunerative that the loss in the returns of the kelp trade has to be balanced by a rise in the price of the iodine.*

The hope of a fall in the commercial value of iodine in consequence of its extraction from the mother-liquors of nitrate of soda has not been fulfilled. The production of iodine from this source has increased but little, and some nitre refineries, which had commenced the utilisation of the iodiferous mother-liquors, have again abandoned the attempt.† On the other hand, in tinctorial industry attempts have been made to dispense with the use of iodine. Although the attempt to employ bromine in place of iodine (see "Bromine") has failed, other methods have recently been discovered for producing the most magnificent violet, blue, and green tar colours without the aid of iodine. Nevertheless the price has not been essentially reduced since the methods for preparing the dyes without iodine have not by any means been adopted in all establishments.

In addition to the tinctorial arts iodine is employed in scientific chemistry, where its importance is incalculable and also in photography and in medicine.

(To be continued).

ON SOME EFFECTS PRODUCED BY THE ADDITION OF SULPHATE OF ALUMINA IN THE TREATMENT OF SEWAGE.

By A. McDONALD GRAHAM, F.C.S.

In your review of a recent publication, "Causeries Scientifique" (Chem. News, vol. xxxiv., p. 69), the reader's attention is directed to the following paragraph:—"Sulphate of alumina, on which so much dependence has been placed, certainly clarifies the sewage. The gelatinous alumina agglutinates the solid substances, but the dissolved matters, mineral and organic, are nowise retained." The last sentence, which is a very faithful translation from the original, contains a statement which is neither new nor true, and the language employed reminds one of the great Dr. Johnson's way of disposing of the swallows in autumn. "Numbers of them," says the learned Doctor, "conglobulate together, and precipitate themselves into the water." That the application of sulphate of alumina to the sewage removes nothing but the suspended matter has been asserted over and over again by persons who, from their position, would have been supposed to have known better; and perhaps it would not be amiss, now that the

* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzehends."

* According to a letter from Mr. E. Stanford, of Glasgow, to Prof. A. W. Hofmann, a ton of chloride of potassium in 1863 cost £21 13s.; in the ten following years on an average £15 15s., and is now worth only £7 15s. The price of iodine has risen in a corresponding degree; in 1863 an ounce of iodine cost 4½d., on the average of the following ten years 7d., whilst it is now worth 1s. 3d. per ounce.

† According to private communications from M. E. Schering the production of iodine from the mother-liquors of soda saltpetre is again on the increase. A Peruvian nitre refinery, which separates the iodine as cuprous iodide by means of bisulphite of soda and sulphate of copper, produced, in 1873, 15,000 kilos. cuprous iodide, and is about to increase its production to 50,000 kilos., corresponding to 30,000 kilos. of iodine.

public attention is turned to the sewage question, to recapitulate some of the substances carried down by alumina. And, first, the phosphoric acid is removed from the sewage, and by its removal the effluent water is found to be less liable to putrefaction, while the manure derived from the sewage must be to some extent improved, although I am aware the value of phosphate of alumina as a manure has been called in question.

Secondly, albuminoid substances are carried down by the alumina. I think this is proved by the general behaviour of bodies of this nature with alumina, and also by the percentage of nitrogen found in the precipitated mud, which is higher than would be produced by the suspended matter alone. The albuminoids are found to undergo rapid decomposition and to give forth offensive odours, and their removal tends to keep the effluent water sweet.

Thirdly, the fatty acids of soap dissolved in the sewage are carried down by the alumina—a point which, I think, has been hitherto somewhat overlooked. It is true that there is some loss in the subsequent drying of the mud, but a considerable portion of these fatty bodies is obstinately retained by the alumina, as may be proved by experiment. I am inclined to think that the beneficial effects produced by the sewage manure on the land is in a great measure due to the large quantity of fatty matters precipitated by the alumina. Farmers have assured me that they found the manure of considerable value, and I think the effect of the fatty matters on the soil has not up to this moment been sufficiently considered.

An enterprising firm proposed some time ago to manufacture artificial butter from the Thames mud, and I have myself made a very fair cake of soap from the fatty acids extracted from the sewage mud. The association of ideas, however, is not agreeable, although I do not think the most fastidious person would object to burn a candle which had been derived from the sewage.

In some of the Towns of Yorkshire—Leeds, for instance—I have been told that a large quantity of soap is found in the sewage, not because the Yorkshire folk are more frequent in their ablutions than other people, but from the fact that soap is extensively used in the manufacturing processes, and it is possible that some portion might be recovered from the sewage. If so, the question of "How are you off for soap?" when addressed to corporations and local boards, would assume a new significance, as its recovery from the sewage would form some set-off to the expense of purification.

Wellfield Villa, Turnchapel, Plymouth.
October 27, 1876.

ANALYSIS OF AN IRON DEPOSIT.

By G. PATERSON.

The deposit of which an analysis is given below is from the surface of the Lochar Moss, a very extensive peat moss now in part under cultivation in the south of Scotland, bordering on the Solway Firth. It is found in large quantity in the open ditches and drains; in the latter it is formed in such considerable quantity that the tiles in time become entirely choked up, so that they have to be raised and cleaned. In the ditches it forms, below the running water, a layer of thick red-brown slime, often 10 to 12 inches in depth; and as these ditches have to be cleaned out at least once in the twelve months, and sometimes even more frequently, the amount of the deposit—which, by the way, is commonly known in the district as "iron ore"—thrown up on the banks in course of time is very large. Perfectly clear water taken as it runs from the drains reacts strongly for proto-salts of iron, becomes cloudy after standing a few hours, and deposits a red-brown sediment.

The sample taken for analysis was collected from an open drain, and was quite free from any foreign matter; the deposit was allowed to settle, the water decanted off, and the residual slimy matter dried at 100° C. before analysis.

Examined under the microscope the deposit proves to consist almost entirely of the Confervoid Algæ, *Didymohelix ferruginea*, together with a small amount of amorphous ferric precipitate.

	Per cent.
Organic matter and water	50·74
Ferric oxide	43·29
Ferrous oxide	3·58
Lime	0·51
Magnesia	0·10
Sulphuric anhydride	1·29
Phosphoric anhydride	0·18
Sulphur	0·15
Soluble silica	0·31
Sand	0·65
	100·80

Laboratory, Wallasey Ore Yard,
Birkenhead

COUNTRY LABORATORY APPARATUS.

No. I. Flower-Pot Gas Furnace, Crucible Jacket, &c.
No. II. Rough and Ready Method of Estimating Volatile Matter and Coke in Coal.

By EDWARD T. HARDMAN, F.C.S.,
H.M. Geological Survey, Ireland.

No. I. The following short description of an extremely effective, cheap, and cleanly substitute for crucible jackets, &c., may be useful, especially to those who, like myself, have occasion to shift their quarters often, and are obliged to work with a necessarily limited laboratory accommodation.

The ordinary crucible jacket being made of sheet-iron has in reality but one use—to protect the flame from currents of air. The small concentration of heat which it affords may be regarded as nearly *nil*, since, from the nature of the material and its thinness, radiation takes place very freely.

Another drawback it has, is that it soon becomes rusty or coated with scale. It is not only dirty to handle therefore, but also presents the inconvenience of dropping some of its scale into the crucible if not carefully manipulated. Then it is an awkward thing to pack, taking up a good deal of space, rusting everything it comes in contact with, and behaving generally in a disagreeable manner; while, as it is not to be obtained in country towns, it may not be left behind.

Now an ordinary earthenware flower-pot answers the purpose in every respect. It is the proper shape, and being made of a non-conducting material it in a great measure prevents loss of heat from the burner. It is extremely cleanly to use, and last but not least, it can be procured in every town or village at the small cost of one halfpenny or so; so that there is no necessity to cumber oneself with it when moving.

The bottom of the flower-pot has a circular hole. This serves for the introduction of the Bunsen burner. As the supply of air would be insufficient otherwise it will be necessary to enlarge the opening. This can be easily done with a knife, and I find it best to cut the aperture nearly in the form of a cross, and not too large. One or two trials will give the happy medium. A current of air is then obtained which not only steadies the flame, but acts in some degree as a blast. The flower-pot may be supported in the ring of a retort stand in the usual way. The chimney is a second flower-pot inverted. To support it the handiest way will be to make three S hooks of stout wire, and having passed the narrow end of the pot upward through the ring, fix the rim within the hooks caught on the ring, as in fig. 1.

It will be found convenient to devote a small retort stand permanently to the purpose. The whole arrangement is shown in fig. 2.

This will be very handy, as the upper part can be raised to any desired height, regulating the heat and draught; or can be shifted from side to side, whenever it is desirable to inspect the progress of the operation going on.

The apparatus acts admirably as a small gas furnace for crucible operations, such as the fusion of silicates with carbonate of soda—as in the analyses of rocks; while for simple ignition of precipitates it renders the flame of a common glass spirit-lamp most effective. The size of the flower-pot required will, of course, depend on that of the crucible and of the burner used. I find the smallest size, 3½ inches high and about 3 inches diameter at top (internal), most generally useful.

The support for the crucible may be either a triangle of wire covered with pipe shank, the end of the wire being bent upwards and formed into hooks so as to hang on the edge of the flower-pot (fig. 3), or three pipe-covered wires suspended in the position of the ribs of a crucible jacket. The former is necessary for small crucibles.

The flower-pot also makes an excellent lamp screen, for steadying and concentrating the flame under evaporating basins, &c.; of course a sufficient interval must be kept between the pot and the basin, else the light will be extinguished.

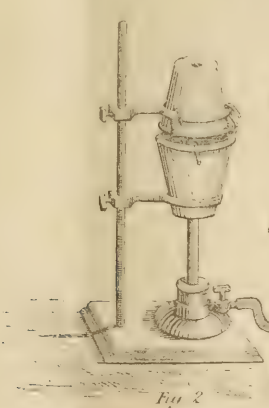

Fig. 2

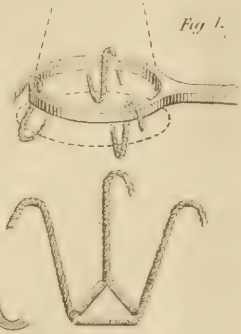

Fig. 1.

Fig. 3

A small flower-pot with wire gauze tied over the top is a very effective low temperature lamp when the gas is lighted below the gauze. If the gas is lighted above the gauze we have a capital argand lamp giving a large clear blue flame. In the latter case a common burner can be used, a consideration when Bunsen's are all temporarily occupied or not available.

After a time the pots become cracked from the heat, but as they are easily replaced this does not matter, and even when cracked they will often hold out for a considerable time. Fireclay flower-pots made rather thick would, however, afford a really good cheap and portable furnace.

It has just occurred to me that by placing the flower-pot inside another just large enough to encase it, loss of heat by radiation would be effectually checked.

No. II. The usual method of estimating the volatile matter in coals implies a laboratory on rather an extensive scale. A furnace with a good draught is required. The coal is placed in a large porcelain crucible, which is then put into a Hessian crucible, and covered with powdered charcoal to exclude air. The cover being then put on, the whole is exposed to strong heat in the furnace for an hour or two, when the volatile matter is driven off. After cooling the difference of weight against that determined before ignition gives the volatile matter. Having occasion to determine the volatile matter of a coal, and not having at hand the elaborate arrangements referred to above, I bethought me of the schoolboy's method of manufacturing coal-gas. The retort he uses is a common clay tobacco pipe. A piece of coal is put in, the top is luted with clay, and the pipe is inserted in the fire-grate with the stem projecting. Presently a dense smoke issues from it, and a match being applied a veritable gas light—but not "16-candle"—results. On opening the luting a piece of coke is found in the pipe. I suppose most of us have performed this experiment. It is obvious that it is only necessary to weigh the pipe and contents before and after the operation, and we have the volatile matter and coke determined.

The larger the pipe the better. Those I have used hold about 100 grains of coal broken small but not powdered. The pipe is weighed, then filled with the coal and weighed again to obtain weight of coal. Then inside the top is fitted a circular piece of writing-paper, the use of which is to prevent any of the luting getting down among the coal, where it could not be removed, and would falsify the last weighing. The top is luted with moist fireclay, or with the cement used for luting the covers of gas retorts, and the pipe, being placed in a common coal fire or in a gas furnace—that described above (No. I.) answers very well—from ten to twenty minutes completes the operation. When cool the luting is carefully taken off and the charred paper removed. The pipe and contents being then weighed, the loss gives the volatile matter, the same weighing, of course, determining the coke. If a very exact determination is required, a quantity of the coal may be broken small, well mixed together, and four pipes filled as above. They can all be ignited together in a fire, and weighed very quickly. The results will be found to agree very closely.

The figures thus obtained do not differ from those given by the same coal assayed on the laboratory plan to a greater amount than will be found to occur between two experiments made on the same coal in the latter way. And the tobacco pipe process has the great advantage of being very expeditiously performed—the whole experiment including weighings not occupying more than thirty minutes—and with very simple apparatus.

Kilkenny, October 9, 1876.

ON THE ACTION OF DIFFERENT FATTY OILS UPON METALLIC COPPER.*

By WILLIAM THOMSON, F.R.S.E., F.C.S.

(Continued from p. 177.)

Series I.—Short Strips of Copper covered completely by the Oils.

(Commenced October 1, 1875. Examined August 9, 1876.)

Name of Oil.	Appearance of oil when examined.	Appearance of strips of copper.	Relative amounts of copper contained in solution in the oil	Relative amounts of the copper salt dissolved by water	Relative amounts of basic green [illegible]
1. *Mesina Olive Oil.*	Yellowish colour and limpid.	Thickly coated with salt of copper; green incrustation.	Trace.	Trace.	Trace.
2. *Olive Oil.*	Ditto.	Ditto.	Trace.	Trace.	Trace.
3. *Rape Oil.*	The oil is of a brownish-yellow colour.	The slip of copper is covered with a slight dark coloured deposit.	Trace.	Trace.	Trace.
4. *Refined Rape Oil.*	The colour has changed to a deep green.	The slip is quite bright.	Very large.	Large.	Rather large.
5. *Cotton Seed Oil.*	The oil has acquired a very slight greenish hue, and has formed a ring of icicle forms all round the glass at the surface of the oil; these forms are of coagulated oil.	The plate or slip is covered all over with thin patches of green copper salt and dark coloured deposit, mixed with tufts of solid fatty matter, which has also deposited on the copper which lies at the bottom of the oil.	Very small.	Trace.	Absent.
6. *Pale Cotton Seed Oil.*	This has changed in every respect exactly like 5, with the exception that the icicle forms are not so thick.	The copper slip is covered slightly with a dark deposit.	Small.	Trace.	Very small
7. *Linseed Oil.*	A tough skin covers the surface of the oil, which has assumed a deep green colour.	The copper slip appears quite bright.	Very large.	Very large.	Large.
8. *Oil of Almonds.*	The oil has acquired a slight greenish hue.	The slip is covered with a very slight dark coloured deposit.	Rather large.	Moderate.	Small.
9. *Sperm Oil.*	The oil is of a dark brownish colour.	The slip of copper is quite bright.	Extremely large.	Very large.	Large.
10. *Raw Cod-liver Oil.*	The oil has become as thick as jelly, and is of a dark amber colour.	Ditto.	Large.	Large.	Large.
11. *Pale Seal Oil.*	The oil has become of a thick syrupy consistency, of the same colour as 10, but lighter.	Ditto.	Moderate.	Small.	Small.
12. *Seal Oil.*	The oil has the same consistency as 11, but is slightly darker in colour.	Ditto.	Moderate.	Small.	Small.
13. *Lard Oil.*	The oil has become slightly greenish in colour.	The slip is covered with a greenish-black deposit.	Large.	Small.	Trace.
14. *Foreign Neatsfoot Oil.*	The oil is of a yellowish colour; white flakes and pellets of solid fats have settled to the bottom, and fill it to about one-third the volume of the oil.	The slip of copper is thickly covered with a green deposit of copper salt.	Trace.	Absent.	Rather large.
15. *Tallow Oil.*	Has become solid, with a honeycombed appearance, produced by irregular, cell-like deposits of solid fat mixed with the liquid oil.	The slip is covered with a green deposit of copper salt.	Absent.	Absent.	Rather large.
16. *Neatsfoot Oil.*	A white deposit of solid fat has settled to the bottom; the supernatant oil is almost colourless and quite limpid.	The slip is covered with a thick green deposit.	Absent.	Absent.	Very large.

* Read before the British Association, Glasgow Meeting (Section B.).

Name of Oil.	Appearance of oil when examined.	Appearance of strip of copper.	Relative amounts of sulphuric acid contained in solution in the oil.	Relative amounts of the same acid contained in water.	Relative amounts of acidity given to water.
17. *Cotton-seed Oil.*	The oil is almost colourless, but has a greenish hue; a ring of coagulated, oil-like icicles are attached to the glass at the surface of the oil.	A dark coloured deposit covers the surface of the copper.	Small.	Trace.	Large.
18. *Palm Oil.*	No change appears to have taken place in the oil.	The slip is covered with a bright green deposit of copper salt; at some parts, however, the copper appears quite bright.	Very small.	Very small.	Large.
19. *Whale Oil.*	The surface of the oil is covered with a thick, hard skin, but the oil is quite fluid underneath.	The copper slip is quite bright.	Trace.	Trace.	Large.
20. *Cod Oil.*	The oil is of a dark amber colour, and is covered with a soft, elastic skin, and has the consistency of jelly.	Ditto.	Very small.	Trace.	Very large.
21. *Shark Oil.*	The oil is of a reddish brown colour and quite liquid.	Ditto.	Moderate.	Trace.	Large.
22. *Newfoundland Cod Oil.*	The oil has a syrupy consistency and dark amber colour.	Ditto.	Very large.	Small.	Very large.
23. *Common Seal Oil.*	The oil has a syrupy consistency and a dark bright amber colour.	The slip of copper is quite bright.	Very large.	Small.	Very large
24. *East Indian Fish Oil.*	The oil has a light yellowish-brown colour.	Ditto.	Trace.	Absent.	Very large.
25. *Heavy Mineral Oil.*	The oil has a dark reddish-yellow appearance.	The copper slip is covered with a very slight greyish deposit.	Absent.	Absent.	Absent.
26. *Mineral Oil.*	The oil has a brownish-red colour.	The slip is covered with a slight dark grey deposit.	Absent.	Absent.	Absent.

(To be continued.)

A PROCESS FOR OBTAINING ALKALI FROM SEAWEED.

At the Chemical Works at Aalborg, in Jutland, Denmark, where about 30 tons of alkali are made per week by the ammonia process, Mr. Thowald Schmidt, the Director of the Manufactory, proposes to work, in conjunction with this process, a method devised by himself of treating seaweed so as to obtain iodine, potash salts, and other marketable products therefrom. In Denmark a very heavy duty is levied on the importation of common salt, whilst enormous quantities of seaweed rich in iodine and potash can be obtained at small cost in the neighbourhood of the works. Mr. Schmidt's process is as follows:—After the seaweed is dried and burnt a concentrated solution of the ash is made and added to the liquor containing chlorides of sodium and calcium, left after the ammonia has been recovered in the ammonia-soda process by boiling with lime. The sulphates of potash, soda, and magnesia contained in the ash of the seaweed are thereby decomposed, and hydrated sulphate of lime and hydrated magnesia are precipitated in a form which may be available for paper-making as "pearl-hardening." The last traces of sulphates are got rid of by adding a small quantity of solution of chloride of barium. To the clear solution nitrate of lead is now added until all the iodine is precipitated as iodide of lead, which is then separated by filtration and treated for the production of iodine or iodides. After filtration the liquid is boiled, nitrate of soda is added to convert the chloride of potassium present into nitrate of potash. The latter is separated by crystallisation. There remains a solution of common salt containing traces of ammonia from the previous soda operation and a trace of chloride of potassium. This solution is again treated by the ordinary ammonia-soda process for the production of bicarbonate of soda and white alkali.

ON ANTHRACENE TESTING.

By DR. FREDERICK VERSMANN.

(Concluded from page 193).

I have stated at the beginning of this article that the failure with sulphuric acid induced me to look for another test and led me to the separation of the products of oxidation into crystals and powder. It was natural, therefore, that I should apply the sulphuric acid not only to the mixture but also to the two separate products, and the results thus obtained point with almost absolute certainty to the conclusion that the powder is practically useless, and is, in fact, no anthraquinone at all.

I have tried the usual sulphuric acid and also fuming or Nordhausen acid, the use of which naturally suggested itself from its application in the alizarine manufacture. The results obtained do not sensibly vary, but I have adopted the last acid as the strongest and most active, and I may state that in speaking of sulphuric acid I always mean fuming or Nordhausen acid.

The samples treated, a small proportion of which only are given in the first table, are so different that it is necessary to record the separate results; but I am anxious to condense the matter as much as possible, and I have therefore in the following table reduced to one-half the number of experiments of the first table. The treatment with acid was carried out in the following manner:—

The products of oxidation were for ten minutes heated in a small porcelain basin or in a large watch-glass with ten times their weight of acid at a temperature not exceeding 110° C.; they were then allowed to stand for twelve hours, largely diluted with water and brought on a double filter, well washed, dried, and weighed. In the following table the first line of each number gives the

percentage and melting-point before, the second line that after treatment with sulphuric acid :—

Action of Sulphuric Acid.

No.	Crystals and Powder Mixed.	Crystals.	Powder.
	276	278	280
6.	15·2 274—275	10·2 274—276	4·6 270—275
	278	279	
	14·4 276—277	9·8 277—278	4·2 not at 300
	278	277	278
8.	16·2 274—276	11·6 273—275	5·2 266—272
	276	275	
	14·6 274—275	10·8 275—275	3·7 not at 300
	270	277	
9.	17·8 266—268	9·8 273—275	7·7 not at 300
	272	277	
	12·2 272—272	9·6 275—276	3·0 not at 300
	279	277	
0.	18·2 271—275	14·2 275—276	3·9 not at 300
	279	278	
	16·9 273—276	13·9 274—276	3·2 not at 300
	278	277	
11.	20·2 274—276	16·3 273—275	3·7 not at 300
	280	278	
	19·8 276—278	16·0 274—276	2·4 not at 300
	277	281	276
13.	22·0 273—275	18·3 273—277	4·0 266—272
	276	279	
	21·3 276—276	18·2 277—277	2·6 not at 300
	270	276	260
14.	23·3 266—268	15·1 272—274	8·0 256—258
	270	274	
	21·8 270—270	14·6 274—274	6·1 not at 300
	280	280	271
16.	26·4 274—277	22·1 276—278	4·2 261—266
	276	280	278
	24·6 276—276	22·1 276—278	1·2 278—278
	277	278	270
17.	27·0 273—275	20·8 274—276	6·1 260—265
	276	276	
	24·4 276—276	20·0 276—276	3·1 not at 300
	278	278	
20.	34·8 268—273	30·0 276—277	4·6 not at 300
	278	278	
	31·2 276—277	29·7 276—277	4·2 not at 300
	271	275	262
23.	39·9 267—269	34·0 273—274	5·8 258—260
	273	275	
	39·3 273—273	33·6 273—274	5·2 not at 300
	278	278	276
24.	41·7 276—277	38·3 276—277	3·3 264—270
	279	278	
	39·8 279—279	37·8 276—277	0·4 not at 300
	268	275	246
26.	49·5 268—268	40·9 271—273	8·7 250—248
	270	274	
	48·4 270—270	40·4 272—273	8·1 not at 300
	280	280	
27.	52·5 272—276	47·9 274—277	4·7 not at 300
	280	280	
	49·7 278—279	47·2 278—279	4·2 not at 300
	279	280	
28.	56·3 275—277	53·9 274—277	2·6 not at 300
	278	278	
	55·3 278—278	52·9 278—278	0·7 not at 300

The action is perfectly uniform with samples of the most varying percentages. The mixture of crystals and powder, originally of a more or less light yellow colour, was in all cases darkened by separated carbon; the loss in percentage is mostly considerable; the melting- and solidifying-points are slightly improved; and, taking this series by itself, the results might well be estimated as pure quinone. But this idea will soon prove most erroneous.

The crystals are very little affected both in percentage and melting-point; they retain their original pure colour; no carbon is separated; and they are undoubtedly pure quinone both before and after treatment with acid.

But the powder shows a totally different character. In most cases the percentage is largely reduced, while the melting-point, which before could only be noted in nine out of fifteen cases, has altogether disappeared. The expression "not at 300" means, in most cases, the substance slightly softens and becomes charred at that temperature. In most cases the residue from the treatment with acid was simply carbon, and no crystals could be detected even under the microscope; in a few instances some well-defined crystals were observed, but the relative quantity was insignificantly small, and had no effect upon the melting-point; No. 16 forms the only real exception, and I look upon the 1·2 per cent of powder as good quinone.

I look upon this result with the powder as of considerable importance, because it clearly shows that by the separation of crystals and powder the actual truth has been more nearly approached than before, and also because it affords a pretty accurate insight into the nature of different samples.

As an illustration I will take one sample, No. 9 in first table, which is of a very exceptional character, for which reason I have also submitted it to the process of purification by two consecutive treatments, the results of which are given in Nos. 17 and 27. This sample represents, as I know, a lot of anthracene obtained by the re-distillation of anthracene oil, *i.e.*, oil from which the anthracene has been separated. It is of course well known that large quantities of such anthracene are made and sold simply because no ready means were known to prove its more than doubtful quality. By the usual test this sample would appear to be of a fair average quality, but the splitting up into crystals and powder is much more striking than the action of sulphuric acid. But the last table shows the action of the acid upon the products of usual quinone test not to give anything like accurate results; the melting-point of the mixture is misleading, and the powder in the mixture is not so well acted upon by the acid as in the separate form.

This leads me to a short consideration of Messrs. Meister, Lucius, and Brüning's "new and improved method," which, I think, has but little chance of being adopted, and I find my opinion shared by several people here whose judgment must be of considerable weight. I consider this method as not practical, because it is too delicate for practical working, and consequently the results will not be correct. I think it scarcely possible without loss to transfer the solution of quinone in hot acid from one basin to another considering the small quantities in hand, and I look upon this operation as an unnecessary addition to the already large number of manipulations—more than twenty from beginning to end—as the solution may be heated and cooled in the same basin. This is a minor objection, but I take it as practically impossible to separate the quinone from carbon by heating the dish, *i.e.*, to completely volatilise the first without burning a particle of the last or without the last retaining any of the first.

Above all this method is based upon the assumption that the acid destroys everything except quinone, which it certainly does not. I have made several experiments with samples of commercial quinone, dissolving them in acid, treating them like anthracene samples, *i.e.*, boiling them with chromic acid in the usual manner, also separating the product into crystals and powder, and finally treating these with sulphuric acid.

A detailed account of these experiments I must reserve for a future occasion, but I will state the results arrived at clearly bring out the fact that sulphuric acid does not destroy all impurities.

Before concluding I wish to say a few words on the melting- and solidifying-points of pure quinone. I have long been under the impression that the pale yellow colour of quinone was due to some trace of impurities, and that perfectly pure quinone was quite white. I have purified a quantity by repeated re-crystallisations from petroleum spirit and sulphuric acid alternately, but the final result is not absolutely colourless, it shows the faintest trace of very light yellow.

The melting-point of quinone is given by different observers as 273, 275, and 276. I find it even a little higher; the very pure sample melts and solidifies at fully 277, which degree I am inclined to look upon as the current one.

In conclusion I may remark that to fix the relative commercial value of per cent unit by my test it may perhaps be desirable at first to combine with it the usual test, thus giving as the result of the analysis, percentage and melting-point of crystals and powder mixed, and of crystals and powder separate. A very short time will suffice to bring out the relative value of per cent.

35, Whitecross Place, Wilson Street,
Finsbury, E.C.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, November 2nd, 1876.

Professor ABEL, F.R.S., President, in the Chair.

AFTER the minutes of the previous meeting had been read and confirmed, and the presents announced, the following names were read for the first time:—Messrs. W. C. Davis, J. Clark, T. Tyrer, F. H. Marshall, T. G. Charlesworth, J. Wood, Griffith Jones, B.A., J. Falconer King, and C. C. Capel. For the third time:—Messrs. Thomas H. Johnson, Otto Hehner, G. C. Thomson, H. A. Bernays, W. J. Fuller, and Gustav Auerbach, who were ballotted for and duly elected.

The PRESIDENT then announced that the Goldsmiths' Company had generously contributed £1000 towards the Society's Research Fund, started some time since by Mr. Longstaff.

Mr. LUPTON read the first paper, "*On the Oxides of Potasstum.*" After mentioning the experiments of Davy, Gay-Lussac, Thénard, and others, he described the method by which he had obtained some new oxides of potassium: this consisted in passing air, and in some cases nitrous oxide, over metallic potassium gently heated to a known temperature in a glass flask. In this way he had, by stopping the action at certain stages, obtained three new oxides,—K_8O_5, K_6O_4, and K_4O_3,—but could find no evidence of the existence of an oxide of the composition K_4O.

The PRESIDENT having thanked the author, a communication "*On certain Bismuth Compounds*" (Part III.), by Mr. M. M. P. MUIR, was read by the SECRETARY. In it the author describes two new bismuth chromates, namely, $3Br_2O_3,7CrO_3$ and $5Bi_2O_3,11CrO_3,6H_2O$, the former being of a light orange colour and the latter brick-red. The action of bromine on hot bismuthous oxide was found to give an oxybromide of the formula $Bi_{11}Br_7O_{13}$. On passing dry ammonia over the bismuth oxybromides, $Bi_8Br_{16}O_{15}$ and BiOBr, metallic bismuth was obtained. The author has also succeeded in preparing a hypobismuthic hydrate, Bi_2O_4,H_2O, by suspending the oxide in potassic hydrate solution and passing in chlorine at 100° until the oxide had acquired a chocolate-brown colour.

The next paper was "*On Phospho- and Arseno-Cyanogen*," by Mr. W. R. HODGKINSON. As chloroform is converted into formonitrile or hydrocyanic acid by the action of ammonia, it was hoped that an analogous compound, containing phosphorus or arsenic in place of nitrogen, would be obtained on substituting PH_3 or AsH_3 for ammonia. A variety of experiments were tried by acting on chloroform and iodoform with nascent phosphine in different ways, but the results were very unsatisfactory. On the other hand, a solution of iodoform in anhydrous alcohol or ether, when treated with arsine, yielded a reddish brown amorphous precipitate, containing carbon, hydrogen, iodine, and arsenic, and which is insoluble in most menstrua. This substance is still under investigation.

"*A Secondary Oxidised Product formed during the Reduction of Stannic Ethide to Stannous Ethide*," by W. R. HODGKINSON and G. C. MATTHEWS. On treating an aqueous solution of stanno-diethyl chloride or bromide with zinc, it is reduced to stannous ethide, whilst a small quantity of a yellowish green amorphous solid is produced by a secondary process of oxidation. After being repeatedly washed with ether and with strong hydrochloric acid, to remove adhering stannous ethide and metallic zinc, &c., it was thoroughly washed, and dried *in vacuo* over sulphuric acid. The results of the analyses were found to agree with the formula $C_5H_{15}SnCO_2$. This substance does not combine with acids. It fuses and volatilises slightly at 100°.

The thanks of the Society having been given to the authors of these papers, a preliminary notice by Messrs. W. R. HODGKINSON and H. C. SORBY was read, on "*Pigmentum nigrum, the Black Colouring-matter contained in Hair and Feathers.*" When perfectly white hair or feathers are heated gently with dilute sulphuric acid for some time they completely dissolve, but if black or brown feathers or hair are thus treated an amorphous black residue is obtained. This substance, which exists only in very small quantity in the blackest feathers, may be conveniently prepared from rooks' feathers (which yield about one per cent) which have been separated from the central rib, and thoroughly cleaned from waxy and fatty matter by treatment with alcoholic ammonia. On digesting them with successive quantities of dilute sulphuric acid for several days, until the acid ceases to be coloured by red or brown soluble colouring matters, a black residue is obtained, which, after being thoroughly washed with dilute hydrochloric acid at 80° C., and then with water, is dried, and the last trace of fatty matter finally removed by treatment with boiling alcohol and ether. On analysis it gives numbers agreeing very well with the formula $C_{18}H_{16}N_2O_8$. It is not acted on by dilute acids or alkalies, but nitric acid slowly oxidises it. It forms new compounds by the action of bromine, one of which is soluble in water, and gives a characteristic absorption spectrum.

In reply to a question from the President, Mr. SORBY said he had regarded the subject of the colouring-matter of hair and feathers more from a biological than from a chemical point of view. Having found that a black residue was left on heating feathers with the dilute acid, Mr. Hodgkinson had undertaken to investigate chemically the nature of the substance. The black pigment was found in black, brown, and dark red hair, but in the latter it was associated with a brown pigment soluble in dilute sulphuric acid. In very bright red hair he had also found a pink colouring-matter. The feathers of birds were of two kinds, namely, those which contained the *pigmentum nigrum*—including the iridescent feathers, such as those of the peacock, which are really black—and another class of feathers, like those in the crest of the crowned crane, which are not iridescent, but contain various coloured pigments. He considered it very important, from a physiological point of view, that this matter should be more fully investigated. With regard to the pigment of the negro's skin, he had not examined it, but had no doubt

that it would prove to be identical with that found in the hair.

Mr. Sorby exhibited a specimen of *pigmentum nigrum*, and also specimens illustrating the colours obtained with this pigment and others soluble in the dilute acid.

Prof. Church said his attention had been entirely directed to the feathers in twelve species of turacoa, in which the red parts of the feathers were coloured by turacin. This differs in an important point from the *pigmentum nigrum*, in that its ash consists wholly of oxide of copper. The amount of copper present in turacin is considerably larger than he had formerly stated: this was owing to the fact that when turacin is distilled a red coloured substance passes over which contains copper. This, unlike turacin, is insoluble in ammonia, but soluble in ether.

The President, having thanked the authors for their extremely interesting communication, adjourned the meeting until Thursday, November 16th, when the following papers will be read:—"On Barwood," by the late Dr. Anderson; "On Potassium Trioxide," by G. S. Johnson; "On the Coal-Gas of the Metropolis," by J. S. D. Humpidge; "On Calcium Sulphate," by J. B. Hannay.

PHYSICAL SOCIETY.

November 4th, 1876.

Professor G. C. Foster, F.R.S., President, in the Chair.

The following candidates were elected Members of the Society:—Warren de la Rue, D.C.L., F.R.S., and W. H. Preece.

Dr. Guthrie read two letters which he had received from Dr. Forel, in continuation of a communication he made to the Society on the 27th of May last, in reference to the "Seiches" or periodic oscillations which take place in the Swiss lakes, and on which he has recently made an elaborate series of observations. Since his communication he has found, in a pamphlet by Dr. J. R. Mérian, published in 1828, a formula strictly applicable to the phenomena under consideration. If t be the duration of half an oscillation, h the depth of the lake, and l its length:—

$$t = \sqrt{\frac{l}{g}} \left(\frac{e^{\frac{\pi h}{l}} + e^{-\frac{\pi h}{l}}}{e^{\frac{\pi h}{l}} - e^{-\frac{\pi h}{l}}} \right)^{\frac{1}{2}}.$$

Considering that probably this formula will be applicable to lakes of irregular depth if h be the mean depth, he has applied it to several, and the following are some of his results:—In the case of transverse seiches on Lake Leman the formula gives 216 metres as a mean depth, and 334 metres is the greatest known depth. With a longitudinal oscillation the mean depth is found to be 130 metres. In the case of Lake Wallenstadt, the formula having shown the mean depth to be somewhat greater than the generally accepted greatest depth, Prof. Forel took a number of fresh soundings, and found a great basin of comparatively even bottom, and of such a depth as to render probable the mean depth given by the formula.

Mr. O. J. Lodge suggested that the formula would be rendered more simple by using the hyperbolic function. It would then become—

$$t = \pi \sqrt{\frac{l}{g}} \coth \frac{\pi h}{l}$$

Mr. Lodge also exhibited the curve which this equation represents.

Dr. Stone exhibited some diffraction gratings on glass and metal, ruled for him by Mr. W. Clark, of Windsor Terrace, Lower Norwood. The majority of them were close spirals, about 1000 to the inch, which, when held between the eye and a distant lime-light, exhibited circular spectra of great brilliancy. The slight difference between the spiral and true circles appeared to exercise no appreciable effect on the result. The metal gratings were of linear form, 1000 lines to the inch, intended for use by reflection in a spectroscope. The spectra thus obtained were of much greater brilliancy than those ordinarily obtained by refraction, and presented obvious advantages for examining the ultra-violet rays. He explained the mechanical difficulties which had been surmounted in their manufacture, together with the manner in which the diamond cutters are prepared. The metals hitherto employed, namely, cast-steel and German silver, are objectionable, and Dr. Stone proposes, on the suggestion of Prof. McLeod, to employ speculum metal, and will report the result of the experiments more fully at a subsequent meeting.

Dr. Guthrie then briefly described some experiments which he had made to determine the effect of a crystalloid on a colloid when in the presence of water. Mr. Graham, in his classical researches, made numerous experiments with a salt on one side of a colloid membrane and water on the other, and Dr. Guthrie thought it might be well to determine what action, if any, takes place when a salt is added to a solution of a colloid such as size. Two or three lumps of rock-salt were added to a jelly of size, and the whole hermetically sealed in a glass tube. The colloid parted with its water readily, a saturated solution of the salt was obtained, and the size became perfectly white and opaque, having undergone a structural change. Experiments were also made, employing a more hygrometric salt, such as chloride of calcium.

Mr. W. C. Roberts pointed out that a jelly containing 5 per cent of silicic acid readily parts with water to sulphuric acid, and dries into a hard glass-like hydrate of silica. He asked whether this might be considered as analogous to the action of salt on size, or whether the strong affinity between the acid and water removed it to another class of action.

Dr. Guthrie thought it might be possible to establish the existence of a point at which the jelly did not give up its water to the hygrometric substance. He also pointed out the analogy between a jelly and a mass of small bags filled with liquid.

NOTICES OF BOOKS.

Water Analysis: a Practical Treatise on the Examination of Potable Water. By J. Alfred Wanklyn and Ernest Theophron Chapman. Fourth Edition, rewritten by J. Alfred Wanklyn, M.R.C.S., &c. London: Trübner and Co.

We are by no means surprised that a new edition of this work has become necessary. The increasing attention paid to public health and the growing conviction of the importance of a pure water supply, must lead to a higher appreciation of the analytical process first made known in its pages—a process which may truly be said to have rendered the sanitary examination of water possible, which, if not absolutely perfect, is by far the most satisfactory we yet possess, and which has been adopted by competent and disinterested judges in most parts of the civilised world.

The present edition is by no means a mere reprint o those which have appeared before. The body of the work is now divided into three sections; the first part being devoted to "water analysis for general sanitary purposes." If the question is merely whether the water of a

given well can be safely used for domestic purposes, Mr. Wanklyn considers that a reply may be obtained from the results of the determination of total solids, of chlorine, of free and albuminoid ammonia, and of poisonous metals, if present. Instructions for these determinations are given in successive chapters and require no further comment, since this portion of the work has not undergone any essential modification.

The second part of the book "is more especially designed for those who make analytical chemistry a profession," and contains minute directions for the execution of a complete mineral analysis of a water-residue. These instructions will be of great service to the chemist who is consulted on the selection of a water supply for any town. This part of the work has been rearranged, modified, and considerably extended. We have, first, a chapter, not found in the earlier editions, on the specific gravity of natural waters. Then follows the determination of the insoluble, and of the soluble solids in the water residue, and of the alkalinity. Here we find an account of an improvement for the details of which the author declares himself indebted to a private communication from Dr. Mohr, and which will be of great use in all cases where very small amounts of alkali in the state of carbonate have to be determined volumetrically. Mr. Wanklyn remarks that the alkalinity of water expressed as grains of carbonate of lime per gallon is almost identical with the insoluble solids.

The section on "Hardness" is extended by the addition of a method for the titration of magnesia in drinking waters, the operation being capable of completion within a quarter of an hour. Next follows a chapter on the "General Quantitative Analysis of the Water Residue," under which head we find directions for the determination of sulphates, nitrates, iodates, &c., and phosphates, which latter, however, the author considers can rarely be present except in infinitesimal proportions.

In stating the results of an analysis, Mr. Wanklyn disapproves of the method of "stating the quantity of each metal and each acid-radical in a given volume of water," which, he considers, "has the fatal property of masking and concealing most fundamental facts that the analysis should disclose." He holds that "water residues may be looked upon as impure carbonate of lime or impure chloride of sodium." The chapter on the "purification of water" contains much novel and interesting matter. The decomposition, or otherwise the removal, of such bodies as quinine, morphia, and strychnine by passage in solution through charcoal must lead to further results. The chapters on "Gases and Vapours Dissolved by Water" and on "Urine and Sewage" are substantially the same as in the last edition.

The third part of the work is composed of "Examples of Complete Mineral Analyses," and deals with the water supplies of London, Manchester, Sunderland, Croydon, and Bonn, and with the waters of the Rhine and the Nile.

The appendix contains a republication of the original memoirs of Messrs. Wanklyn, Chapman, and Smith, on the action of oxidising agents upon organic substances in alkaline solution, and a reprint of documents bearing on the controversy between the author and Dr. Frankland as to the merits of their respective processes for the analysis of water. To pronounce upon this portion of the book would be an invidious task. We do not like prolonged controversies, and we find that a man with a grievance, however good his case, often comes to be regarded as a bore. But if an author is attacked, and if his reply is excluded from the journal where the attack is published, he can scarcely be blamed for defending himself wherever it is practicable. Nothing, we think, is more certain to find its level than an analytical method.

In fine, we must express our opinion that this edition of Mr. Wanklyn's work will meet with even higher and wider approval than its predecessors in accordance with its greatly increased value.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances, de l'Academi des Sciences. No. 15, October 9, 1876.

Absorption of Free Nitrogen by the Proximate Principles of Vegetables under the Influence of Atmospheric Electricity.—M. Berthelot.—According to experiments which have been made free nitrogen is directly absorbed at the ordinary temperature by organic matters under the influence of the electric *effluve* (*Comptes Rendus*, lxxxii., p. 1283). This absorption takes place both with pure dry nitrogen and hydrocarbons, a case in which oxygen is totally excluded, and with moist cellulose and dextrin (p. 1357). The author's experiments demonstrate the influence of a natural cause, hitherto scarcely suspected, and nevertheless of great importance for vegetation. When the effects of atmospheric electricity have been taken into consideration, its luminous and violent manifestations, such as thunder and lightning, have been chiefly regarded. Upon whatsoever hypothesis the formation of nitric and nitrous acids or of nitrate of ammonia have been exclusively studied. But the author's experiments show a new and hitherto unknown action, which works unceasingly under the most serene sky, and which determines a direct fixation of nitrogen in the principles of the tissues of plants.

On Capillary Affinity.—M. E. Chevreul.—The author refers to experiments on this subject described in his earlier writings. He advises all chemists who desire to know the degree of certainty which ought to be attributed to analytical methods to examine both their reagents and the bodies that have been separated with the spectroscope.

Action of Boric Acid and of the Alkaline Borates upon Plants.—M. E. Peligot.—The author finds that boric acid and borates of potassa and soda have a destructive action upon vegetables. He therefore doubts the propriety of their use for the preservation of articles of food, and suggests that their action upon animals should be carefully investigated by a commission nominated by the Academy of Sciences.

Reciprocal Action of Oxalic Acid and the Monoatomic Alcohols.—A. Cahours and E. Demarcay.—Not suitable for abstraction.

Determination of Free Nitrogen in Organic Substances: Chemical Composition of certain Gun-cottons (Abel's Compressed Gun-cotton, Collodion-Paper, and Collodion.—P. Champion and H. Pellet.—The authors have applied to the determination of nitrogen the methods of Pelouze or of Schlœsing with an important modification. When nitro compounds are not capable of being carried along by the vapour of water they employ the arrangement which has been suggested by M. F. Jean (*Bull. de la Soc. Chim.*, June, 1876, p. 13). The authors consider compressed gun-cotton, prepared by Abel's method, not as tri-nitro-cellulose, $C_{12}H_7O_{73}NO_5$, but as penta-nitro-cellulose, $C_{24}H_{15}O_{155}NO_5$. They have found the composition of a Russian sample of collodion obtained from M. Carette. A sample of pyroxylised paper only contained two equivalents of nitric acid.

Limits within which the Explosion of Fire-Damp is Possible, and on New Properties of Palladium.—M. J. J. Coquillion.—It is difficult to obtain a strong explosion with air and fire-damp on working upon small quantities of gas, as is done in laboratories. 1 part of fire-damp with 6 of air, and 16 of air with 1 of fire-damp, are the two extreme limits. Palladium wire, even if heated to white-redness, does not fire the most explosive mixtures.

No. 16, October 16, 1876.

The session of the Academy was opened by a discourse pronounced by M. Dumas, on occasion of the death of M. C. Sainte-Claire Deville, the well-known mineralogist.

Relation of the Two Specific Heats of a Gas.—M. C. Simon.—It is concluded that in simple gases the physical molecules remain sensibly invariable in form and dimensions so long as no electric or chemical phenomenon is produced.

Etching Action Produced upon Different Metals by the Acids.—MM. Tréve and Durassier.—It is known that the action of acids upon metals gives rise to various figures which have been sometimes considered as calculated to throw a light upon the internal structure of the metal. We have had occasion to make certain observations, which seem to show that in the conditions in which we operated the figures are connected, not with the internal structure, but with the external action exerted by the bubbles of gases disengaged during the reaction of the acids. The authors give an illustration representing two horse-shoe magnets which have been plunged into acids, and which are grooved in a regular design, not capable of being made intelligible by a mere description.

Compound of Chloral and of Acetic Chloride.—MM. J. Curie and A. Millet.—The result is a liquid heavier than and insoluble in water, soluble in alcohol, ether, and glacial acetic acid, boiling without decomposition between 186° and 188°, and containing 62 per cent of chlorine.

Sulpho-antimoniuret of Lead found at Arnsberg, in Westphalia.—M. F. Pisani.—This mineral is not a plagionite, as might at first sight be assumed, but a true heteromorphite. Its hardness is 2·5, and its specific gravity 5·59 to 5·73. Its composition is—

Sulphur	19·90
Antimony	31·20
Lead	47·86
Zinc	0·60
	99·56

Origin of Eruptive Rocks, Vitreous and Crystalline.—A. M. Lévy.—An examination of the microscopic structure of two eruptive rocks, which, in the opinion of the author, may throw some light on the origin of vitreous and crystalline rocks.

Justus Liebig's Annalen der Chemie, Band 183, Heft 1.

Compounds of Phthalic Acid with the Phenols.—Adolf Bæyer.—The first part of a long but interesting memoir. The author treats of fluorescein, its history, preparation, properties, and salts; of diacetyl-fluorescein, dibenzoyl-fluorescein, monoethyl-fluorescein, diethyl-fluorescein, and chloride of fluorescein. He shows that fluorescein can take up a molecule of water without decomposition, and that two molecules of resorcin can be successively withdrawn from it. He then proceeds to the reduction-product of fluorescein, known as fluorescin, and examines the behaviour of the former body with different reagents, and its substitution-products, including dinitro-fluorescein, diacetyl-dinitro-fluorescein, the hydrate of dinitro-fluorescein, and tetra-nitro-fluorescein. He then treats of the action of bromine upon fluorescein, and the production of mono-brom-fluorescein, dibrom-fluorescein, diacetyl-dibrom-fluorescein, and tetra-brom-fluorescein (better known as eosin), the salts of eosin, and erythrin with its salts. The second chapter of the treatise is devoted to orcinphthalein, and is taken from an inaugural dissertation by E. Fischer.

On Boron.—Dr. W. Hampe.—The author shows that the supposed crystalline boron obtained by Wöhler and Sainte-Claire Deville by fusing aluminium with amorphous boron or with boracic acid is not pure boron, but compounds. To the black crystals he assigns the fomula AlB_{12}, and to the yellow kind $C_2Al_3B_{48}$. The determinations of the specific heat of boron are hence no longer trustworthy, with the exception of those of Kopp, executed with amorphous boron, the number found being 0·254. This multiplied into the atomic weight of boron, 11, gives 2·798, a product half as large as that of most other elements. All attempts to obtain pure crystalline boron have been unsuccessful. The author is engaged with an investigation of the purity of amorphous boron as prepared by the method previously employed.

Contributions to the Theory of Luminous Flames. Dr. Karl Heumann.—In this part of his treatise the author arrives at important results, both theoretical and practical. He shows that the carbon in the flame exists as a solid body, and not, as Frankland assumes, in the state of vapour. He finds that gas-jets of steatite are decidedly preferable to those of iron, since they consume less gas for an equal strength of light. Metallic jets, in general, notably enfeeble the light. He refers to the result obtained by the Commission of the English Board of Trade who reported, in opposition to the view of Vogel, that a refrigeration of the gas does not decrease the amount of light, and considers that they must have experimented with a kind of gas poor in hydrocabons capable of condensation. On the contrary, he finds that if the jet and the outflowing current of gas are both strongly heated the luminous effect is increased to an extraordinary degree.

Presence of Guanin in the Urine of Swine.—Domenico Pecile.—The swine in question had been fed upon bran alone, and was evidently suffering from gout. The author is endeavouring to ascertain the presence or absence of guanin in the urine of healthy swine.

MISCELLANEOUS.

University of London.—The following is a list of the candidates who have passed the recent B.Sc. examinations:—*Pass List.*—First Division. John Henry Best, University College; Thomas Capper, Trinity College, Cambridge; John Kent Crow, Owens College; William Hewitt, Royal School of Mines; William Wansbrough Jones, Magdalen College, Oxford; John Frederic Main, Trinity College, Cambridge; Hermann Ludwig Theodor Sack, B.A., private study; Ambrose Robinson Willis, Royal School of Mines. Second Division. Reginald Hargreaves Bulley, Owens College; William Fisher, B.A., King's College; Cecil Reeves Harrison, University College; John Stephenson Jellie, private study; Archibald Prentice Ledward, Owens College: Archibald McAlpine, Royal College of Science, Dublin; George William Mackie, B.A., private study; Henry Major, B.A., private study; James Monckman, Yorkshire College of Science; James Isaac Paddle, B.A., University College; Walter Pearce, St. Mary's Hospital and Royal School of Mines; Bernard Joseph Snell, B.A., New College; Edward Holdsworth Sugden, B.A., Owens and Headingley Colleges; Albert Edward Tovey, private study.

Science Scholarships.—In the *Dublin Daily Express*, Professor Galloway calls attention to a paper on "Technical Education," read at a recent meeting of the Iron and Steel Institute by the secretary, Mr. Jones. In this paper the author said that the Commissioners of the International Exhibition of 1851 have still a surplus of £186,000, and that it had been proposed to expend £100,000 of this on a scientific library and on science scholarships to be attached to the Science School at South Kensington. He proposed that it should be distributed amongst the different science colleges and institutions in England. Professor Galloway asks Irish members of Parliament to get this distribution extended to Ireland. He hopes, at least, that a chemical scholarship will be obtained for the College of Science, Dub lin

The students at this college have, he says, never yet been equalled at the London University examinations by the students from any of the other colleges in the United Kingdom. They have hitherto invariably obtained honours in chemistry. In 1870 a University Exhibition was established. It was not awarded in the first two years. The College of Science gained it both in the fifth and seventh years. No other institution has taken it twice, and it has only been gained once by three others—viz., Guy's Hospital, University College, and the School of Mines. The competition for honours is very severe. Sixty students went in this, the seventh, year of the exhibition, and only ten passed, and two of such were students, and the only students, from the College of Science.

MEETINGS FOR THE WEEK.

Thursday, Nov. 16th.—Chemical, 8. "On Barwood," by the late Dr. Anderson. "On Potassium Tri-Iodide," by G. S. Johnstone. "On the Constituents of Methyldia," by J. S. O. Humpidge. "On Calcium Sulphate," by J. B. Hannay.

TO CORRESPONDENTS.

A Daggett.—Consult the "Student's Number" of the Chemical News, published September 15th last.

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THE CHEMICAL NEWS.

Vol. XXXIV. No. 886.

ON REPULSION RESULTING FROM RADIATION.—PART II.*

By WILLIAM CROOKES, F.R.S., &c.

Continued from p. 178.

97. Two other forms of the bulb-apparatus require mentioning. A thin glass bulb was blown 2¼ inches in diameter (fig. 4). Inside this another bulb was blown 2 inches in diameter, at the end of a glass tube 12 inches long. In this a light glass index with pith terminals was suspended, and the whole was perfectly exhausted. Fig. 5 shows the complete arrangement. In the space between the two bulbs various liquids were enclosed, such as water, solutions of sulphate of copper, alum, perchloride of iron, sulphate of iron, bichromate of potash, sulphate of nickel, &c. These were selected in the hope that amongst them one would be found which would sift out the heat-rays, and so allow me to obtain an action due to light. They, however, only affect the dark or extreme red heat-rays, and do not affect the luminous rays which also have a heating effect. By throwing a beam of sunlight on one of the pith disks powerful repulsion was obtained,

Fig. 4.

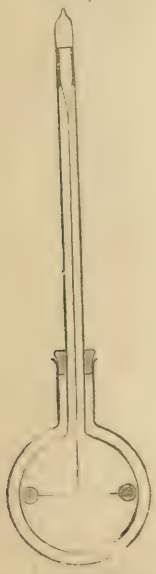
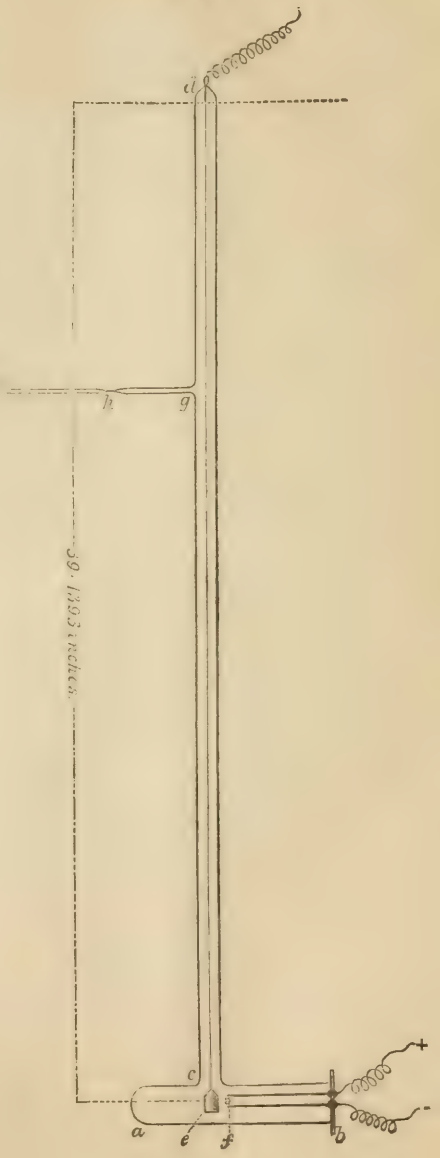


Fig. 5.

whatever was the surrounding shell of liquid. That all these liquids allowed heat to pass through was proved with a thermopile. Solution of sulphate of copper was the most opaque to heat.

98. Another form of apparatus is shown in fig. 5. Two

Fig. 6.



bulbs were blown one in the other, and they were fused together at the necks; to the neck a small tube was fused for connecting with the Sprengel pump. The space between the two bulbs was then perfectly exhausted, and the small tube sealed up. I thus possessed what might be called a spherical shell of vacuum surrounding a bulb open to the air. In this inner bulb was suspended a pith ball on the end of a glass arm balanced by a knob of glass on to the other end, the suspending fibre being protected by a glass tube fitting into the neck of the inner bulb with a cork. It was found that heat applied to any part of the outer bulb passed across the vacuum, and *attracted* the pith ball (suspended in air). The spherical shell of vacuum across which the heat passed, therefore, produced no change of action, but simply behaved like an extra thick glass bulb. This experiment bears upon the speculation in par. 81 of my former paper on this subject.

99. Having succeeded in proving the fact of repulsion resulting from radiation, I was desirous of getting some quantitative estimations of the forces under examination. A pendulum-apparatus was constructed as shown in fig. 6. A wide glass tube (*a b*) has fused to it a narrower tube (*c d*), about 40 inches long; *e* is a turned mass of magnesium, weighing 42 grains, suspended by a very fine platinum wire, the distance between the point of suspension and the centre of gravity of the magnesium bob being 39·139 inches, so that it forms a seconds' pendulum; *f* is a spiral made of platinum plate, fastened to two stout copper wires which pass through the thick plate of glass *b*, and thence pass to a contact-key and a battery. The plate *b* is cemented (83) to the end of the tube *a b*, which is ground flat. *g* is an arm fused into the upright tube for the purpose of connecting it to the glass spiral of the pump; it is contracted at *h* for convenience of sealing off. The fine platinum wire is fastened at its upper end to a thick wire which is sealed into the glass, and passes through to the outside for electrical purposes (120). The distance between the pendulum bob and the spiral is 7 millims. To ignite the spiral the current from two Grove's cells was used; this brought it to a bright red heat in air, and to a white heat in vacuum.

Three feet from the pendulum a telescope was firmly clamped to the bench; it was furnished with a micrometer eyepiece, with movable spider threads and graduated circle. The edge of the magnesium bob was brought into the same focus as the traversing cross wire. Observations were taken in the following manner:—The observer at the telescope brought the cross wire to zero, and then adjusted it to coincide with the edge of the pendulum bob. An assistant, guided by a seconds' watch, pressed the contact-key down for one second, then broke contact for a second, next made contact for the third second, and so on, alternately making and breaking contact for either 10, 20, or 40 seconds, counting the seconds aloud. At each second the swing of the pendulum increased; and the milled head of the micrometer was kept turning so as to let the cross wire keep up to the furthest point to which the pendulum vibrated. At the end of the experiment the position of the cross wire was taken and its distance from zero recorded.

(To be continued.)

ON ANTHRACENE PRODUCTION.

By Dr. FREDERICK VERSMANN.

My investigation on anthracene testing, published in the last three numbers of the Chemical News, has brought me many inquiries and communications, which induce me to supplement this purely scientific investigation and its practical application by some remarks on the commercial aspect of anthracene manufacture generally: and I do so simply because I think my information may enable me, perhaps, to throw some light upon this important question, and also because a crisis in this manufacture seems to become inevitable, and that in no distant time, the serious consequences of which it may well be worth while to weigh and to consider beforehand.

We all recollect the profound sensation created by the grand discovery of artificial alizarine and its manufacture on the large scale, which last commenced only five or six years ago. In recalling the sanguine expectations raised by this new industry, its present dismal position appears scarcely credible, and yet the fact stands out only too clearly that no other branch of chemical industry, inaugurated under such bright auspices, has in its results fallen so short of just expectations,—nay, I might also say, has become so disastrous to nearly all persons who remained engaged in its pursuit. True the first pioneers —those who were actually at work while the first excitement was at its height—were wise enough to sell their fortunes at prices which brought them large profits. First among these stood Messrs. Gessert Brothers, who sold their at that time flourishing concern to a Company, and the English alizarine manufacture, which has since changed hands a second time.

Putting aside a very few German alizarine makers, who profess to work at a profit, we have at present a disheartening list of many large undertakings who are hopelessly insolvent, or at least uncomfortably near to it.

In Germany all public companies are very properly compelled by law to publish their annual balance-sheet in at least three newspapers, and such document—published only on the 10th inst., in the *Cologne Gazette*—by the "Chemische Industrie Actien Gesellschaft zu Elberfeld," formerly Gessert Brothers, tells its own tale in a few figures. This official document informs the shareholders that the loss of the twelve months' working, ending at Midsummer last, amounts to £40,000; and as this dismal statement is merely a repetition of previous equally unsatisfactory balance-sheets, there seems to be little doubt that at next month's general meeting the Company will be wound up, and that very likely the whole capital—amounting to some £180,000—will be lost.

Again, a private firm, Messrs. Schœneberg and Hufschmidt, also of Elberfeld, recently suspended payment, with liabilities estimated at £90,000 and assets £60,000, or a deficit of £30,000.

The "Stuecktarberei Gesellschaft" and the "Elberfeld Aniline and Alizarine Gesellschaft," also joint-stock companies, are defunct for some time, their capital having been entirely lost.

Plain facts like these—and the list might easily be made more complete—may well lead to an inquiry into the cause of such calamity. It may be justly argued that bad management, want of skill or proper knowledge in the manufacture, and, above all, the general depression in all trades, especially in the cotton trade and everything depending upon it, have a great deal to do with the non-success of so many undertakings; but I believe the real and primary cause to be the most unhealthy state of the anthracene manufacture.

The fact is the production of anthracene far exceeds its demand, which, suddenly sprung up some years ago, tempted many distillers to manufacture an article of a very doubtful quality; competition unreasonably ran up the price of tar, and the principal benefit was pocketed by the gas companies, and by them alone.

I am induced to give a few figures, which will clearly show this disproportion, and which I feel sure will be very near to the actual truth, because I have every reason to depend upon their correctness.

Up to the end of 1877 there will be produced in England alone, including present stock, at least 1400 tons of *pure* or 100 per cent anthracene. The requirements of all the alizarine works at present do not exceed 2 tons a day, or 600 tons a year, of *pure* anthracene. The next year is expected to see a considerable increase, but if with present low prices we even double the quantity—making it 1200 tons—England alone will produce 200 tons of pure anthracene more than required.

But it must not be forgotten that the Continent also supplies large quantities. The Paris Gas Company utilise their own residues, and produce, together with the other large French towns, at least 250 tons. Belgium—and more so Holland—is very active, and the production in Germany, especially in large towns, such as Berlin and Hamburg, is not inconsiderable, and even America sends her quota, if not in large quantities. Altogether there will be during 1877 an excess of many hundreds of tons of pure anthracene, and consequently low prices. The inevitable reaction will produce a reduction in the price of tar, which already shows itself in Germany. A paper there offers repeatedly, and for some time, six tar contracts without any response: the distillers bide their time, and their English brethren will soon find out, if they have not done so already, the necessity of this line of action.

But—and here I come to the main point of my argument insisted upon in previous communications—the tar distiller must feel to find his advantage in the manufacture of a better and purer article. He must return to the early times of his operations, when with low tar prices a moderate price for anthracene paid him well.

The large stock accumulating during 1877 may somewhat interfere, but after that the permanently reduced prices of tar will enable him to supply genuine anthracene at paying prices.

It is well known that true, pure anthracene passes over at a certain limited stage of the distillation, and this product only was originally sold: the suddenly increased demand for large quantities induced the distiller to separate as much solid hydrocarbons as possible, and thus the quality of anthracene deteriorated to such a degree that any article tested by alcohol, and showing a melting-point of 190° C., was sold as anthracene. The increasing impurity of the merchandise called forth improved methods of analysis, until at last the chemist is obliged to demonstrate, by more delicate tests, that most of the anthracene at present in the market is of a very doubtful character.

I think the tar distiller may well bear this in mind, because upon the good quality of anthracene to a great extent depends the future existence of the alizarine manufacturers, and the more flourishing these the better will be the prices of anthracene.

35, Whitecross Place, Wilson Street,
Finsbury, E.C.

ON ANTHRACENE TESTING.

By C. CASPERS.

In consequence of the publication of Messrs. Meister, Lucius, and Brüning's, "New Method for Ascertaining the Exact Quantity of Pure Anthracene Contained in Crude Anthracene," and by Dr. Frederick Versmann's subsequent Report on his treatment of crude samples "in a different direction," I am induced to publish my views on the above subject, which may be interesting to science and the trade in general.

The analysis of crude anthracene, since this article became of commercial importance, has undergone various remarkable alterations, and certainly great improvements. The alcohol and bisulphide of carbon tests were simply intended to give a guidance as to the insoluble portion in a certain quantity of mixed hydrocarbons contained in the last runnings of coal-tar distillates, and are now entirely out of practice through their unsatisfactory results, though checked by a stipulated melting-point of the residue.

The so-called "Meister, Lucius, and Brüning's Anthraquinone Test," is based upon the action of certain oxidising agents upon anthracene ($C_{14}H_{10}$) *only*, and at the same time upon the destruction of all other hydrocarbons mixed with it. The obtained residue, treated with a hot solution of dilute caustic—with or without the appendix—is supposed to be a pure oxidised compound of anthracene, viz., anthraquinone ($C_{14}H_8O_2$) an intermediate and valuable article in the manufacture of artificial alizarin.

It is unquestionable that the ascertaining of the portion, which, in more or less crude anthracene, undergoes an oxidation by the above method and shows itself as residue, fairly forms a guidance for the alizarine maker as to the corresponding quantity of alizarine which can be yielded therefrom, and consequently this test has a reasonable basis; but how far—chemically speaking—it may be correct is the question at issue, equally important to anthracene as to alizarine makers.

Since the original anthraquinone test came into use I have always been at a loss to understand why the weight of the oxidised residue should be calculated by a certain coefficient (0·856) into "pure anthracene," and sold by the number thus obtained instead of by the original weight of the residue, because, I may say, nearly all coal-tar distillers, even those who work under the direction of efficient chemists, have unpersuadedly to believe that the specific gravities of quinone and anthracene are in proportion like 1000 : 856; and also because the residue itself is the very article the alizarine maker requires and should pay for accordingly.

Messrs. Meister, Lucius, and Brüning's methods are *not* for ascertaining the exact quantity of pure *anthracene* in crude anthracene, but for ascertaining pure *anthraquinone*; the latter is the direct result, whereas the former is a calculation therefrom.

I shall hereafter go more fully into the question as to the value of Messrs. Meister, Lucius, and Brüning's proposed treatment of quinone with sulphuric acid, my experiments not having led me, up to the present, to a final conclusion, but this I can say, that the calculation of found quinone into anthracene is quite unnecessary, and this practice ought to be abolished. The price per unit of quinone will soon find its level in the natural course of trade.

With regard to Dr. Versmann's interesting Reports on his separation of crystals from powder, which at the first reading of his elaborate experiments on various samples seems to be a valuable improvement on the hitherto adopted mode of testing, the same will, after carefully examination be found impracticable and unreliable.

It is only fair for me to state that, as a personal friend of the Doctor's, I had, about four months ago, the advantage of being confidentially acquainted by him of his above mode of testing, and that since I have had an opportunity of completing a series of experiments in a similar way as described by him, but with quite different results; yet I can scarcely object to the Doctor's very cautious and reserved remark about the value of his method, viz., that it "*may tend to throw some light on the nature of the products obtained.*" My intention is merely to state some of my results as compared with his own.

Dr. Versmann puts great importance on the ascertaining of the melting-points of his products, based upon the principle that pure quinone melts at 273° C., but he seems to have lost sight of his own most contradictory results in that respect. I refer to his Report about the "Effect of Purifying Two Samples of Anthracene by Two Consecutive Treatments" (Chemical News, vol. xxxiv., p. 193) in which he finds the powder of the "1. Original" not to melt at 300° C.; first treatment, mean, 265° C.; and second treatment, not at 300° C. again. The "2. Original" does not melt at 300° C.; first treatment at 270° C.; second treatment, not at 300° C. What can prove more the instability of the melting-point?

I now may be allowed to state the results of my tests carried on in a similar manner to Dr. Versmann's suggestion. I have separated a number of crystals from the powder previous to the addition of water to the acetic acid, and never could find more nor less than about 0·038 grm., which I can only explain in this way: that 55 c.c. of glacial acetic acid always keep this quantity in solution, and precipitate it in the form of powder after the addition of sufficient water. If, say, 0·10 grm. of this

powder is dissolved in about 10 c.c. of glacial acetic acid by heating, fine needles of quinone crystallise out in the cold, and melt at about 250° C., which proves that the powder always contains a large quantity of quinone; the original crystals may be purer, but that the powder should be considered a valuable material is the fact that they are below 27° or above 300° C.

My attention was particularly drawn to Dr. Versmann's table (CHEMICAL NEWS, vol. xxxiv., p. 178), test No. 9, showing 17·6 per cent at 268°, of which 9·9 per cent are crystals and 7·7 powder.

The Doctor gave me a part of the above sample to prove to me the correctness of his statements, but I was unable to find more than 0·038 grm. of powder with a mean melting-point of 281°, whereas he finds 0·077 grm. not melting at 300° C.

Dr. Versmann's method is not worth more than he estimates it at, coinciding with my own views, and I doubt whether he will ever succeed in coming to a satisfactory final conclusion on this point."

(To be continued.)

THE D-LINES SPECTRA FLAME EXAMINED BY THE BLOWPIPE.

By MAJOR ROSS, late R.A.

(1.) IN 1871, at Mussoorie, India, a friend, Mr. Hennessey, of the Indian Trigonometrical Survey, since elected Fellow of the Royal Society, invited me to inspect the then novel "atmospheric lines" of the solar spectrum, through the large spectroscope lent him by the Royal Society, from the top of a mountain peak.

(2.) From *a priori* considerations, unnecessary to enter into here, I at that time suspected that the "D" absorption lines of the solar spectrum are *water lines*, and not due to sodium; and I communicated my supposition to Mr. Hennessey, who rapidly appreciated the importance of the deductions possible from such a standpoint.

(3.) In the year above mentioned I found that emission of the so-called sodium flame, afforded by *platinum* before the blowpipe, was wholly dependent on keeping the platinum at a red (not white) heat; so that the *same wire*, incandescent, and affording a continuous spectrum at the *point* of the blue pyrocone, immediately produced an orange (or "D"-lines) tinge again when moved to a cooler part, about a quarter of an inch *inside* the point, and a reddish or rose tint when shifted to the extreme base of the pyrocone.

(4.) I then confirmed this observation by heating a considerable quantity of new clean platinum foil (compactly rolled together by clean steel forceps), which, I ascertained, could not be incandescently heated by the mouth blowpipe, and which therefore never ceased emitting the orange flame.

(5.) *Conclusion from these Experiments.*—It is obvious, here, that if this orange flame (exhibiting spectroscopically only D-lines) be due to sodium, that metal must be in some mysterious manner (*a*) proportional to the *bulk* of the platinum used, and (*b*) eliminable from the blowpipe flame according to the *particular part* of the pyrocone touched by the platinum. The logical conclusion, according to the sodium hypothesis, therefore, seems that sodium exists both in pure platinum and in the blue pyrocone produced by the blowpipe, but that that, in a certain state of heat, is required to eliminate it from this, and that this must be only partially employed to develop it in that.

(6.) It was not until February, 1873, that I made any further progress towards a substantiation of the conclusion I had formed in 1871, but that month, having several weeks before me, I carefully fused some platinum foil in

This was written previous to the publication of Dr. Versmann's paper in the last number of the CHEMICAL NEWS, vol. xxxvii., p. 261.

a large platinum dish over the flame of a treadle blowpipe in the Royal Artillery Institution laboratory, I repeated the experiment with an ounce of pure crystalline *boric acid*. The platinum dish was cleaned with boiling nitric acid, and subsequently with charcoal powder and distilled water. The fused boric acid seemed beautifully white and pure, but, proceeding to test with it pyrologically, I found it became opaque on cooling, and therefore was utterly useless for the purpose.

(7.) I then became convinced that the apparent waste of my time and boric acid was in reality an immense gain of fact, in furtherance of the conclusion I had so long entertained. Confirming the phenomenon with a new platinum spoon filled with pure crystallised boric acid before the blowpipe, it was impossible to avoid the conclusion that these *bulks* of platinum, respectively heatable only to redness by the different means employed, had not ceased during the operation to emit the orange (or D-lines) flame, which, absorbed by the boric acid in each case, had rendered it opaque on cooling, and useless for pyrological purposes.

(8.) This hypothesis was confirmed in the following manner:—A roll of new platinum foil, similar to (4), secured by a piece of wire (*a*), was screwed in a geometrical pen along with another wire (*b*), containing a bead of pure, transparent, fused boric acid, in such a manner that the point of the blowpipe pyrocone, heating (*a*) to redness, caused the orange (D-lines) flame to impinge upon (*b*), which, after a short exposure to this treatment, became *opalescent on cooling*.

(9.) All now required to complete the negative evidence (against the hypothesis of sodium being the cause of the D-lines flame) was a proof of the converse of (8), viz., that an undoubted sodium flame *will not* and *cannot* produce opalescence in a bead of pure fused boric acid. Knowing this to be the case, I went further, and caused the orange flame from a bead of sodium carbonate to impinge upon the opalescent bead (8) from a considerable distance in the geometrical pen. After a few seconds *the opalescence disappeared*, and the bead was perfectly clear on cooling. A ball of cobalt oxide floating in the bead, previously unaffected by the opalescence of (8), was now partially dissolved, giving the whole bead a pink tinge.

(10.) *Conclusions from Experiments* (8) *and* (9).—The argument generally adopted by the defenders of the sodium hypothesis of the D-lines flame is that the quantity of sodium thus alleged to be indicated by the spectroscope is too minute to be detected by any other means, but we have here incontrovertible evidence (*a*) that the reaction afforded by the orange flame emitted from platinum in pure fused boric acid is an *exceedingly strong one*, and (*b*) that it is *exactly the opposite* of that afforded by an undoubted sodium flame. Secondly, to believe that this flame is due to sodium involves the mathematical absurdity of supposing that sodium in combustion can, at one and the same time, *impart* opalescence to boric acid, and *also remove* opalescence from boric acid. It is therefore impossible to believe that the orange flame emitted by red-hot platinum is due to sodium; and if this flame (exhibiting only D-lines in the spectroscope) is not due to sodium in one case it cannot be due to that metal in any.

(11.) If this evidence be admitted, as it apparently must, to be absolutely incontrovertible, I will undertake to prove (in another paper) that the D-lines spectral flame is in reality produced by *water*, in the peculiar combined condition found in *hydrates*, which I have termed "chemical water," and which Dr. F. Guthrie, advancing by other methods of analysis, has termed "solid water."

Destruction of the Vines, etc., of the Cote d'Or.—[illegible] are gradually perishing, though neither in the leaves nor the roots have the most skilful observers been able to find any indications of the phylloxera. The author thinks that some new enemy has made its appearance.—*Comptes Rendus.*

ON THE ACTION OF DIFFERENT FATTY OILS UPON METALLIC COPPER.*

By WILLIAM THOMSON, F.R.S.E., F.C.S.

(Concluded from p. 211.)

SERIES II. LONG STRIPS OF COPPER USED, HALF COVERED WITH OIL.

(Commenced November 9, 1875. Examined August 9, 1876.)

Name of Oil	Appearance of oil when examined	Appearance of strip of copper.	Relative amounts of copper contained in solution in the oil.	Relative amounts of copper dissolved by the oil and deposited on the surface of the copper by water.	Relative amounts of copper dissolved by water.
1. *Messina Olive Oil.*	Yellowish colour and quite limpid.	Thickly coated with green salt of copper, which hung thickly in flakes from the plate.	Absent.	Absent.	Very small.
2. (*Sweet*) *Olive Oil.*	Ditto, but with a slight greenish tinge.	Thickly coated with green copper salt, but not hanging in flakes.	Very small.	Minute trace.	Absent.
3. *Cotton Seed Oil.*	The appearance of the oil does not seem to have changed; it has left a coagulated rim all round the bottle at the surface, like a series of icicles.	The copper slip is coated with a very thin coating of a dark deposit.	Very small.	Ditto.	Large.
4. *Pale Rape Oil.*	The oil has a greenish colour; otherwise not changed.	The copper slip is covered with a green salt of copper immediately at the surface of the oil; underneath it is quite bright.	Large.	Small.	Trace.
5. *Brown Rape Oil.*	Ditto.	The slip is covered immediately at the surface with a green deposit; underneath it is free from green deposit, but slightly covered with a dark deposit.	Large	Small.	Trace.
6. *Castor Oil.*	The oil appears to have changed to a distinctly green colour.	The slip of copper at the immediate surface of the oil is covered with a dark deposit; underneath it is *almost* bright, being slightly covered with a greyish deposit.	Rather large.	Small.	Minute trace.
7. *Raw Linseed Oil.*	The oil has changed to a deep green colour.	The slip is slightly and irregularly covered with a dark coloured deposit only slightly adhering to the surface of the copper.	Very large.	Very large.	Very large.
8. *Palm Nut Oil.*	The appearance of the oil has not changed.	The slip is covered with a thick green coating like the one placed in olive oil.	Absent.	Absent.	Rather large.
9. *Ground Nut Oil.*	Ditto	The slip is covered with a dense coating of green copper salt, the coating being thickest near the surface of the oil.	Trace.	Absent.	Trace.
10. *Pure Lard Oil.*	The oil has assumed a very slightly greenish shade.	The slip is covered with a thin light green coating.	Moderate.	Trace.	Small.
11. *American Tallow Oil.*	The oil has the appearance of honeycomb, the cells being formed by the solid fat and mixed with thin oil.	The slip is covered with a dense green deposit of copper salt thickest near the surface.	Absent.	Absent.	Moderate.
12. *Common Tallow Oil.*	The oil is of a yellowish colour and turbid from crystallisation of solid fat.	Ditto.	Absent.	Absent.	Rather large.

* Read before the British Association, Glasgow Meeting (Section B.).

Name of oil.	Appearance of oil when examined.	Appearance of strip of copper.	Relative amounts of copper contained in solution in the oil.	Relative amounts of the copper salt dissolved by water.	Relative amounts of acidity given to water.
13. *North American Neatsfoot Oil.*	This oil has undergone no apparent change.	The slip is irregularly covered with green deposit in a net form all over its surface, but thickest nearest the surface.	Small.	Absent.	Absent.
14. *English Neatsfoot Oil.*	The oil has changed to a distinctly green colour.	The slip is covered with a very slight dark coloured deposit.	Very large.	Small.	Absent.
15. *American Sperm Oil.*	The oil is of a dark yellowish colour.	The surface of the copper is thoroughly bright. Except in a line where it was touched by the immediate surface of the oil, it has a faint line of a greenish deposit.	Extremely large.	Very large.	Large.
16. *Whale Oil.*	Oxidation had taken place and penetrated from the surface of the oil to about a quarter of its entire depth, forming it into a hard jelly. Underneath this jelly the oil was quite liquid.	The copper was absolutely bright throughout.	Absent.	Absent.	Very large.
17. *Pale Seal Oil.*	The oil all round the glass at its surface had coagulated, forming a circle of small icicle looking bodies; otherwise the oil did not seem to have changed.	The copper slip was absolutely bright throughout.	Large.	Large.	Rather large.
18. *Mineral Oil (lubricating).*	The oil is of a dark reddish yellow colour.	The slip is covered with a very slight brownish deposit.	Absent.	Absent.	Absent.

These results may be classified as follows :—

First. The amount of acid dissolved by the water *from* the oils seems to bear no relation to the amounts of copper dissolved *by* the oils. In some cases the acidity is large and the amount of copper found in solution small or absent, and in others the acidity is small and the amount of copper found in solution large.

Second. As a rule, when the amount of copper dissolved by the oil is large the amount extracted by water is also large, but in a few cases this does not seem to be so.

Third. Some oils produced on the surface of the copper slip a complete coating of a green salt of copper of a greater or less degree of thickness, and it is remarkable that those oils which have this action have not in any case dissolved more than a trace or small quantity of the copper, and in some cases *no* copper in solution was found. The following is a list of the oils which have this peculiar action in the first and second series respectively :—

Series I.	*Series* II.
Mesina olive oil.	Olive oil.
Olive oil.	Olive oil.
Palm oil.	Palm nut oil.
Foreign neatsfoot oil.	Ground nut oil.
English neatsfoot oil.	American tallow oil.
Tallow oil.	Common tallow oil.
	Lard oil.

Some oils fall partly under this classification inasmuch as they are not completely covered with the green deposit but are not entirely free from it. In the first series two oils have covered some parts of the copper plate with a blackish deposit and other parts with a green deposit, viz., one of the samples of cotton-seed oil and lard oil.

In the second series, where the copper slips stood in the oils only partly immersed, two samples have produced green deposits only at the point where the slips came in contact with the immediate surface of the oil. These were pale rape-seed oil and brown rape-seed oil, and one where the line of green deposit at the surface was exceedingly narrow and very slight, viz., American sperm oil; lastly, one sample covered the surface of the copper slip with a network of green deposit, viz., North American neatsfoot oil.

It is most remarkable that no samples of fish oil, with the very slight exception above named of American sperm oil, produced any deposit of green salt of copper on the metallic slips; the surfaces of the copper placed in each of the thirteen different samples used in both series having been preserved in a perfectly bright condition.

Fourth. As a rule those oils which dissolved large proportions of copper, left the surfaces of the copper slips in as bright, or almost as bright, a condition as when they were first introduced. Of the oils belonging to this class may be mentioned :—

Series I.	*Series* II.
Refined rape oil.	Pale rape oil.
Linseed oil.	American sperm oil.
Sperm oil.	Pale seal oil.
Raw cod-liver oil.	
Newfoundland cod oil.	
Common seal oil.	

Some oils in the second series, whilst dissolving large quantities of copper, left the surfaces of the metal more or less tarnished. Of these may be mentioned :—Brown rape oil, castor oil, raw linseed oil, English neatsfoot oil.

The following samples dissolved moderate or small quantities of copper, but left the surface of the slips quite bright :—

Series I.	*Series* II.
Seal oil.	
Pale seal oil.	
Whale oil.	
Cod oil.	
Shark oil.	
East Indian fish oil.	

For Series II., as only three fish oils were employed, only whale oil remains to be placed in this class, although strictly speaking it does not belong to it, as it had not dissolved even a trace of copper. This sample of oil solidified from the surface by oxidation into about one-third the depth of the oil. The oil underneath was quite fluid.

Fifth. The slips of copper in contact with some of the samples were stained more or less with a dark-coloured deposit. The following is a list of those having this peculiar action :—

Series I.	*Series* II.
Rape oil (not refined).	Brown rape oil.
Pale cotton-seed oil	Cotton-seed oil.
Ordinary cotton-seed oil.	Raw linseed oil.
Almond oil.	English neatsfoot oil.

Lastly. The three samples of mineral oils in both series produced on the copper slips a peculiar characteristic deposit, of a greyish colour.

Many of the samples in the first series dissolved only a trace or very small quantity of copper, but only two were absolutely free from even a trace of that metal, viz., English neatsfoot oil and tallow oil. In the second series five samples came under this class, viz., one sample of olive oil, palm nut oil, American tallow oil, common tallow oil, and of whale oil which was protected from the air by a thick coating of oxidised oil on its surface.

With the view to further examine the green copper salt incrustation which had been produced on the slips of copper in some of the oils, I took the slip which had been left in contact with No. 1 olive oil of the second series, which was covered thickly by the incrustation, and from which it hung in flakes: this was carefully scraped off, and part of the excess of oil absorbed by blotting-paper. The incrustation was then transferred to a test-tube, and washed by decantation with petroleum spirit: this dissolved the excess of olive oil, together with a copper salt which coloured the petroleum spirit of a deep blue-green colour on its first treatment. The incrustation was washed so long as the spirit continued to dissolve any copper; the petroleum spirit solution was then filtered, and the filtrate evaporated on a water-bath, to drive off all the spirit. The residue—which consisted of the excess of olive oil, together with the soluble copper salt—was set aside to cool, and in the morning the copper salt was found to have crystallised out in beautiful green feathery crystals.

Ferrocyanide of potassium, added to and shaken with the petroleum spirit solution of the soluble copper salt, at once decolourised the liquor, and threw down all the copper on the ferrocyanide.

The insoluble copper salt, or part of the incrustation, was then submitted to examination. It is a deep green solid, lighter than water, and insoluble in that medium. Part of this salt was placed in a test-tube, and water added, which was gradually heated till about 200° F., when the solid melted to a deep green oily liquid, which floated on its surface. It is insoluble in alcohol, slightly soluble in bisulphide of carbon and in ether, and is decomposed when heated with most of the acids.

Some of the salt was heated in a test-tube with very weak hydrochloric acid, the copper was separated and dissolved in the water solution of acid, whilst a clear, transparent, oily liquid floated on the surface, which when cold solidified to a white compact solid, resembling in appearance bees'-wax, It, however, differs from this and the well-known solid fatty acids by the peculiar way in which it crystallised when placed on a warmed microscope-slide and allowed to cool gradually. When viewed through the microscope by means of polarised light, it crystallises in beautiful small star-like groups of crystals, which have the power of polarising light. This white body is difficultly soluble in alcohol in the cold, but dissolves with facility in hot alcohol. It is easily soluble in ether. I intend to continue my enquiry into the properties and composition of these bodies.

Royal Institution, Manchester,
September 30, 1876.

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 197.)

Chlorine, Bromine, Iodine, and Fluorine.
By Dr. E. Mylius, of Ludwigshafen.

As regards recently discovered sources of iodine we have already mentioned the mother-liquor of Chilian nitre. No others of importance have been discovered. Leuchs† indeed points out that the flue dust of blast-furnaces contains compounds of iodine along with other soluble salts. Thus from the dust of the Rosenberg furnace, near Sulzberg, he obtained 0·034 per 1000; from the Komoran furnace, near Herzowitz, 0·042; and from that at Kreutzthale, 0·146, and calculated that 35½ lbs. iodine could be annually prepared at the first-mentioned furnace. But even in the improbable event that the iodine thus occurring could be extracted at a remunerative cost the total production would still be quite insignificant.

As for the total production of iodine there exist few numerical statements from which it can be ascertained. By far the greatest quantity is obtained in England and France. In the year 1871 the quantity produced in Great Britain reached 114,799 lbs., 9-10ths of which came from Glasgow. One of the works there (W. Paterson) in the year 1867 alone produced 112,000 lbs.‡ In France the production in 1867 was 55,600 kilos.; therefore rather less than in England.

In 1868, 40 kilos. were daily prepared at Tarapaca from Chilian nitre (Balard) corresponding to a yearly production of 290 to 300 cwts. This quantity, however, must be considerably reduced if we remember that Stichtǁ found only 50 per cent of real iodine in a Chilian sample.

The method of extracting iodine is essentially unchanged notwithstanding many proposed improvements.

In the Report of the London Exhibition of 1862, A. W. Hofmann describes the process of Stanford which was then taken up with great zeal, and for which a medal was awarded by the jury. Its principle is the preliminary distillation of the seaweed, and the utilisation both of the volatile products and of the residual charcoal with its mineral constituents. According to this process 20,000 cwts. of seaweed yielded 12,860 litres of empyreumatic oil, 31,000 cubic metres of illuminating gas, and 26 cwts. of iodine, besides other less important products.§ In spite, however, of the favourable expectations which were entertained by experts, this process has evidently failed in practice. The rock on which the invention has been wrecked is the troublesome and costly carriage of the seaweeds, since a great weight of water must be conveyed along with a comparatively small quantity of solid matter. Moride¶ has indeed proposed to improve this method.

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* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzehends."

† Leuchs, *Deutsche Industrie Zeit.*, 1868, 408. *Wagner Jahresber.*, 1868, 15.

‡ *Deutsche Indust. Zeit.*, 1867, 8.

ǁ Sticht, *Wagner Jahresber.*, 1869, 221.

§ *Wagner Jahresber.*, 1864, 186 (from *Journal de Chim. Medic.*).

¶ Moride, *Comptes Rendus*, lxii., 1002. *Monteur Scient.*, 1866, 445.

He proposed to dry the weeds in portable furnaces where they are obtained, but nothing further has been heard of the distillation of seaweed and the production of iodine from the residual charcoal.

The method of extracting iodine from the mother-liquors of kelp is still the same well-known process over which it is needless to waste a word. New methods have been proposed, but have led to no alterations in practice. We may mention the method invented by Lauroy.* He saturates the mother-liquors of Varec with hydrochloric acid, removes the precipitate thus produced, and passes nitrous and hyponitrous acid into the clear liquid. Iodine is thus precipitated, whilst the bromides, simultaneously present, are not decomposed.

The process of extracting iodine from the mother-liquors of Chili nitre, which was at first introduced by Thiercelin in the works of the Société Nitriere, at Tarapaca, and by which, as has been already stated, 40 kilos. of iodine were obtained there daily, is in brief as follows:—The iodic acid present in the mother-liquors is reduced by an exactly sufficient amount of sulphurous acid. The iodine thus precipitated is placed upon a sand filter in a large stoneware vessel with a perforated bottom, which allows the greater part of the saline liquid saturating the iodine to drain away. It is then transferred by means of stoneware spoons into a trough of gypsum with thick sides, which quickly absorbs the rest of the liquid. The crude iodine thus obtained is either offered for sale in this state or submitted to sublimation. Thiercelin subsequently employed for the precipitation of the iodine nitrous acid, which he obtained by the ignition of a mixture of 5 parts soda-saltpetre, and 1 part charcoal (Duhamel's process for the manufacture of the soda).

(To be continued).

CORRESPONDENCE.

NEW REAGENT FOR POTASSIUM.

To the Editor of the Chemical News.

SIR,—In the reports of M. Carnot's experiments upon a new reagent for potassium (CHEMICAL NEWS, vol. xxxiv., pp. 85 and 119-129) a peculiarity—if not an error—in the formulæ occurs which is likely to be misleading. Your correspondent "R. P. D.," who writes to correct M. Carnot's figures (p. 122), has already misunderstood his meaning.

M. Carnot, in every instance (excepting one evident typographical error), expresses sulphide of bismuth—in the old notation—Bi_2S_3 instead of BiS_3—in the new notation—it is generally written. It is written in the same manner in the *Comptes Rendus*, from which one of the articles was translated. Either M. Carnot is in error, or he uses one-half the usually accepted atomic weight for bismuth.

If "R. P. D." will either substitute Bi for Bi_2 in the formula of which he writes, or will halve the weight of bismuth, he will find that M. Carnot's original figures are correct.—I am, &c.,

ALFRED SENIER.

School of Pharmacy, 17, Bloomsbury Square, W.C.,
November 13, 1876.

* Lauroy, *Monit. Scient.*, 1868, 1042.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances, de l'Academie des Sciences. No. 17, October 23, 1876.

The Electric Effluve.—M. A. Boillot.—Two tubes filled with powdered graphite are fixed in a parallel position side by side, but at a variable distance, depending on the intensity of the electricity and on the nature of the effluve which it is desired to obtain. Each of these tubes is fitted at one end with a platinum wire communicating with the carbon within, these wires being opposed to each other, and placed in external connection with the electric source. The effluve is produced along the entire length of the tubes. The gases to be operated on arrive at one of the extremities of the apparatus, and are collected at the other after having traversed a tube intermediate between the two others filled with carbon, and after having undergone the action of the effluve.

COMPOSITION AND QUALITY OF THE METROPOLITAN WATER.

OCTOBER, 1876.

THE following are the returns of the Society of Medical Officers of Health:—

	Appearance in 2 feet Tube.	Ammonia.		Nitrogen as Nitrates, &c.	Oxygen used to Oxidize Organic Matter.	Total Solids.	Lime.	Magnesia.	Chlorine.	Sulphuric Anhydride.	Hardness on Clark's Scale.	
		Saline.	Organic.								Before Boiling.	After Boiling.
		Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Degs.	Degs.
Thames Water Companies.												
Grand Junction	Clear	0·000	0·008	0·135	0·084	20·40	8·288	0·306	0·94	1·80	13·80	2·4
West Middlesex	Clear	0·000	0·008	0·135	0·082	20·41	8·064	0·468	1·01	1·66	13·80	2·4
Southwark and Vauxhall	Slightly turbid	0·001	0·008	0·105	0·050	20·20	8·232	0·468	1·01	1·53	13·80	2·3
Chelsea	Clear	0·000	0·007	0·120	0·077	20·90	8·344	0·468	1·01	1·73	13·80	3·8
Lambeth	Clear	0·001	0·007	0·120	0·091	20·06	8·128	0·442	1·01	1·73	14·30	3·3
Other Companies.												
Kent	Clear	0·000	0·000	0·255	0·010	24·24	10·248	0·576	1·13	1·93	18·20	5·1
New River	Clear	0·000	0·004	0·120	0·027	19·38	7·952	0·468	0·87	0·80	14·30	3·3
East London	Clear	0·000	0·005	0·105	0·037	19·51	7·616	0·568	1·85	1·60	13·30	3·4

The quantities of the several constituents are stated in grains per imperial gallon of 70,000 grains.

NOTE.—The amount of oxygen required to oxidise the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours, and in the case of the Metropolitan waters the quantity of organic matter is about eight times the amount of oxygen required by it.

C. MEYMOTT TIDY.

Industrial Applications of the Phosphide of Copper and of Phosphor Bronze.—M. H. de Rudder, Montcel, and de Fontenay.—The authors claim priority in the preparation and use of phosphor bronze, of which they have cast several pieces of artillery at Douai from 1854 to 1856. They contend that phosphorus, even in infinite doses, when added to heated alloys containing copper produces [illegible] effects.

No. 18, October 30, 1876.

A New Electric Lamp designed by M. P. Jabłochkoff.—In this lamp the new source of light is formed by the incandescence of two rods placed parallel to each other, and separated by an insulating substance capable of wasting away at the same speed as the charcoal. When the electric current begins to pass the voltaic arc is formed between the two uncovered extremities of the two charcoals. The nearest layer of the insulating matter melts, is volatilised, and slowly lays bare the two rods of charcoal just as the wax of a candle progressively uncovers its wick as the combustion is propagated downwards. The heat springing from the combustion of the charcoal is utilised for the fusion and volatilisation of the insulating mixture. The composition of this latter may be varied indefinitely, since most earthy matters may be employed. The simplest mixture provisionally adopted consists of sand and powdered glass, which with an equal electric power gives a light of [illegible] brightness. The author has been able to divide the light produced by a single source of the current. With a single Gramme machine of the common make he has caused three sets of charcoals to burn at once.

Distribution of Magnetism on the Surface of Magnets.—MM. Trève and Durassier.—The authors find that the more highly steel is carburetted the more the magnetism is condensed towards its extremities. On the contrary, the less it is carburetted the more the magnetism is equally spread over its surface.

Circular Polarisation of Quartz.—J. L. Soret and E. Sarasin.—Not suitable for abstraction.

Chemical Reactions of Gallium.—M. Lecoq de Boisbaudran.—When I merely possessed a few milligrms. of impure compounds of gallium I admitted, though not without reserve (*Comptes Rendus*, December 6, 1875, p. 1105), that the oxide of gallium is more soluble in ammonia than is alumina. Recent experiments confirm this opinion. Thus, a mixture of the chlorides of aluminium and gallium having been repeatedly treated with an excess of ammonia, the first ammoniacal solution was found very rich in gallium, and the last precipitate consisted exclusively of alumina. A single precipitation with a large excess of ammonia suffices to yield on the one hand a salt of gallium poor in aluminium, and on the other, alumina containing little gallium. If a mixture of the chlorides of aluminium and gallium is subjected to fractional precipitation with carbonate of soda the rays $Ga\alpha$ 417·0 and $Ga\beta$ 403·1 are most intense in the first product, and subsequently go on diminishing. Still we cannot, in this manner, arrive at a satisfactory separation of gallium and aluminium. Carbonate of soda only precipitates indium after gallium. It is to be remarked that according to a theory which regards gallium as an intermediate stage between aluminium and indium, the precipitation of the oxide of gallium ought to be intermediate between that of the oxide of indium and that of alumina, and not to precede them both, as observation shows. The chloride and sulphate of gallium, if slightly acid, are not precipitated in the cold by acetate of ammonia, also feebly acid, but the same salts, if neutral, are rendered turbid. An excess of acetate of ammonia renders the liquid clear again, but a large excess of water added. Chloride of gallium is very soluble and deliquescent. After having been dried it attracts moisture from the air and liquefies: the solution if very concentrated is clear, but is rendered turbid by the addition of water. The precipitate, doubtless an oxychloride, is only very slowly re-dissolved by dilute hydrochloric acid. Thus, if it be desired to remove all the gallium contained in an insoluble product, it is prudent to heat it with strong hydrochloric acid. If to a concentrated solution of chloride of gallium there is added exactly so much hydrochloric acid that it may be diluted with water without turbidity, we obtain a liquid which precipitates copiously on boiling, but grows clear again on cooling. A slightly acid solution of chloride of gallium, if dried at a gentle heat, deposits crystalline needles or leaflets, which act strongly upon polarised light. Sulphate of gallium is not deliquescent. Like alum, it forms with cold water a clear solution, which becomes turbid in heat, and grows bright on cooling. I have prepared gallium-alum by mixing solutions of the pure sulphates of ammonium and gallium. If protected from atmospheric dust the liquid remains clear, but on contact with a fragment of common alum it deposits voluminous and well-defined crystals of ammonio-gallic alum. The existence of this salt, therefore, is no longer doubtful.

On Terephthalic Aldehyd.—M. E. Grimaux.—Not suitable for abstraction.

Simultaneous Formation of Two Trioxyanthraquinons, and the Synthesis of a New Isomer of Purpurin.—M. A. Rosenstiehl.—This paper will be inserted in full.

Bulletin de la Société Chimique de Paris, Nos. 6 and 7, October 5, 1876.

Nitro- and Amido-Naphthyl Sulphurous Acids, and on their Derivatives (Part II.).—M. P. T. Cleve.—An examination of naphthionic acid, diazo-naphthionic acid, and of the dichloro-naphthalin derived from naphthionic acid.

Two New Modifications of Dichlorated Naphthalin.—M. P. T. Cleve.—These are δ-dichloro-naphthalin, $C_{10}H_6Cl_2$; and ε-dichloro-naphthalin, $\varepsilon C_{10}H_6Cl_2$.

Explanatory Note on the Atomic Theory.—M. E. Bourgoin.—The few lines which follow are not designed to refute the new critical observations which have been addressed to the author in relation to his memoir on atomicity. They are merely intended to rectify two or three assertions which have been gratuitously ascribed to him, and the authorship of which he refuses to admit. He has been made to say that all atomic formulæ spring from the type-formulæ of Gerhardt. He has never put forward such an opinion. It is imagined that he admits the atomic weights of simple bodies to be proportional to their gaseous densities. He has never said anything similar, for the very simple reason that he no more believes in atoms than in the atomic theory, even as perfected by M. J. A. Le Bel.

Various Notes on Analytical Chemistry.—H. Pellet.—Reserved for insertion in full.

Ferrocyanide of Tetramethyl-ammonium.—M. L. Barth.—This compound is obtained by neutralising a solution of hydrate of tetramethyl-ammonium with hydroferrocyanic acid.—*Deutsche. Chem. Ges.*

Action of Halogens upon Ferricyanide of Potassium.—M. Skraup.—By the action of a mixture of ClO_3K and HCl upon a neutral solution of ferricyanide of potassium, and by adding alcohol, the author obtained small black drops, which ultimately became a black crystalline mass. This is doubtless the same body which Bong obtained by the action of chloric acid upon ferrocyanide.—*Deutsche Chem. Ges.*

Compounds of Sulpho-Urea with the Metallic Salts.—M. R. Maley.—An examination of the compounds of sulpho-urea with the zincic, stannous, and mercuric chlorides, cadmic sulphate, and mercuric iodide.—*Deutsche Chem. Ges.*

Derivatives of Sulpho-Urea.—MM. Claus and Rimbach. The authors describe the reaction of sulpho-urea and trichlor-acetic acid.

Substitution Derivatives of Oxide of Ethylen.—M. E. Demole.

Researches on Ethyl- and Methyl-Oxamethan.—O. Wallach and P. West.—These two papers do not admit of useful condensation.

Tetra-Substituted Ureas.—M. W. Michler.—A preliminary notice.

On Oxymercaptans.—R. Biedermann.—The author is engaged with attempts to introduce the group SH into phenol, and the group OH into thiophenol.—*Deutsche Chem. Ges.*

On Gaulterylen.—R. Biedermann.—The author confirms the view of Cahours that this compound is a terpen of the formula $C_{10}H_{16}$.

Action of Cyanide of Potassium upon Halogenated Compounds.—MM. Claus and Beuttel.—Chloro-crotonic ether in an alcoholic solution is treated under pressure with cyanide of potassium. The products are two acids, one of which has received the name of the tricarballylic.—*Deutsche Chem. Ges.*

Product of the Reaction of Potassium upon the Succinate of Ethyl.—Ira Remsen.—This product, which represents the ether of a disuccinic acid, has been further examined by the author.

Amidated Acids.—J. W. Brühl.—An examination of the derivatives of α-chloro-propionic ether.

Hydrazinic Compounds of the Fatty Series.—M. E. Fischer.—The compounds studied by the author are nitroso-diethylen, nitroso-diglycolamidic acid, and nitroso-piperidin. There is also a paper by the same author on the "Aromatic Hydrazinic Compounds."

Aromatic Nitriles.—V. Merz and K. Schelnberger.—Nitriles are formed by the action of yellow prussiate upon the halogenous aromatic carbides.

Action of Aniline upon Nitrobenzol.—MM. Dechend and Wichelhaus.—Already noticed.

Meta-chloro-nitro-benzol, and on certain Chlorinised Nitrogenous Compounds.—M. A. Laubenheimer.—Not adapted for condensation.

Extraction of Sulphur from Pyrites.—P. W. Hofmann.—If sulphide of calcium—*e.g.*, the vat-waste from alkali works—is heated to dull redness in a current of sulphurous acid gas, obtained by roasting pyrites, the latter is at first completely absorbed. Sulphur then distils over, and the sulphide is converted into sulphate, which may be anew reduced to sulphide by calcination in a current of coal-gas.—*Deutsche Industrie Zeitung.*

On Aniline-Black.—M. Nietzki.—Reserved for insertion in full.

On Pittacal.—M. C. Liebermann.—Reserved for insertion in full.

Les Mondes, Revue Hebdomadaire des Sciences,
No. 7, October 19, 1876.

This issue contains no original chemical matter.

Society of Public Analysts.—We are informed on good authority that the Treasurer of the Society of Public Analysts (Dr. Stevenson) has sent in his resignation and retired from the Society.

MEETINGS FOR THE WEEK.

SATURDAY, Nov. 18th.—Physical, 3. "On the Cohesion or Capillary Action of Films of Water, especially when holding Solid Bodies in Suspension against the Action of Gravity," by Alfred Tylor.

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THE CHEMICAL NEWS.

Vol. XXXIV. No. 887.

ON REPULSION RESULTING FROM RADIATION.—PART II.*

By WILLIAM CROOKES, F.R.S., &c.

(Continued from p. 210).

100. Experiments were first tried in air of normal density. The pump was then set to work, and observations were taken at different heights of the gauge. The difference between the height of the gauge and that of the barometer gave the tension of air in the apparatus in millimetres of mercury; this is recorded in the first column of the following tables. The second column gives the greatest amplitude of the half oscillation of the pendulum in millimetres— the sign *plus* signifying attraction, and *minus* repulsion.

Near the centre of Table I., in the second column, are five observations to which I have affixed no sign. When trying the experiments I thought that either I had mistaken the direction of impulse, or my assistant had commenced to count the make-and-break seconds wrongly, as the movement *seemed* to be repulsion. Never having had repulsion at such a pressure before, I was not prepared for it; and fearing there might be an error, left the sign queried. Another series of observations were taken to re-examine this point; they are given in Table II.

Table I.

Tension of enclosed air, in millims. of mercury. Temp. = 16° C. Bar. = 772·55 millims.	Amplitude of half oscillation, in millims., at end of 40″ observation.
772·55	+0·46
557·50	+0·54
472·00	+0·49
372·00	+0·39
322·00	+0·41
272·00	+0·28
242·00	+0·18
222·00	+0·15
201·00	+0·11
167·00	+0·12
140·00	0·07 ?
114·50	0·08 ?
89·50	0·12 ?
70·50	0·03 ?
54·00	0·02 ?
48·00	+0·12
37·00	+0·14
29·00	+0·24
20·00	+0·18
14·00	+0·30
9·15	+0·46
6·55	+0·66
4·65	+1·00
3·15	+1·40
2·25	+1·48
1·15	+1·72
0·75	+1·70
0·65	+1·46
0·55	+1·04
0·35	+0·64
0·25	−0·60
0·15	−1·16
−0·05	−5·90

It is worthy of notice in these Tables that the attraction by the incandescent spiral is only moderate in air of ordinary density. The attraction diminishes to a minimum between a tension of 50 millims. and 150 millims., then rises as the pressure diminishes, until, at a tension of 1·15 millims., the attraction is nearly four times what it was in dense air. Above this exhaustion the attraction suddenly drops and changes to repulsion, which at the best vacuum I could get was nearly thirteen times stronger than the attraction in air.

Table II.

Tension of enclosed air, in millims. of mercury. Temp. = 16° C. Bar. = 772 millims.	Amplitude of half oscillation in millims. at end of 40″ observation.
772·0	+0·460
770·0	+0·540
769·5	+0·570
769·0	+0·440
769·0	+0·520
769·0	+0·440
769·0	+0·450
565·0	+0·560
557·0	+0·540
472·0	+0·490
440·0	+0·550
369·0	+0·416
215·0	+0·233
207·0	+0·130
189·0	+0·180
173·0	+0·140
164·0	+0·100
162·0	−0·100
142·0	−0·120
132·0	−0·130
127·0	−0·090
105·0	−0·140
102·0	+0·083
73·0	−0·130
60·0	−0·123
56·0	−0·136
51·0	−0·030
41·0	+0·150
33·5	+0·170
32·0	+0·106
23·0	+0·110
22·0	+0·080
16·1	+0·170
16·0	+0·140
7·1	+0·380
6·0	+0·293
3·9	+0·610
1·9	+0·880
1·2	+0·755
0·9	+0·340
0·7	−0·740
0·6	−1·700
0·3	−3·800
0·2	−5·080
0·0	−5·680
−0·05	−6·320

The last figure in the first column requires explanation. All the others are obtained by subtracting the height of the guage from that of the barometer, and are *positive*. At the highest rarefactions, however, I get the gauge about 0·05 millim. above the barometer (85, *note*); the sign, therefore, becomes *negative*.

Table II. agrees in the main with Table I. The sign changes to repulsion at pressures corresponding to those queried in Table I.; the repulsion, though slight, was unmistakable. At 102 millims. pressure the observation has a positive sign. This looks like an error; but as it is so recorded in my notebook, and as I was at that time specially looking for repulsions, I do not feel justified in

* A Paper read before the Royal Society, March 20, 1875. From the *Philosophical Transactions of the Royal Society of London* vol. clxv., pt. 2.

altering it. What I have called the neutral point, or the point where attraction changes to repulsion, is in this series lower than in the former. There it occurred at a tension of about 1·9 millim. of mercury; here at about 0·8. Neither has the previous attraction attained such strength. Although the ultimate repulsion is more intense. The agreement is, however, sufficiently satisfactory, considering the lowly method of measurement.

There are many errors almost inseparable from this form of apparatus. The marking and observing contact by hand is not sufficiently certain, and has rarely been a fraction of a second would seriously affect the ultimate amplitude of arc. I tried making and breaking by clockwork, also by a seconds pendulum; but there were difficulties in each plan.

Owing to the mode of suspension, there was uncertainty as to the length of the pendulum. I tried to make it the right length to beat seconds *in vacuo*. Assuming that I had succeeded in this, the pendulum would have executed fewer vibrations in the 40 seconds when oscillating in air, and consequently I should not have got the full benefit from the making and breaking contact supposing these were accurately timed to seconds.

The battery-power varied, being stronger at the commencement, and gradually declining towards the end of the experiments. And even were the battery to remain constant, the spring became much better, owing to the removal of the air from the apparatus, ranging from a bright red heat in air to a full white heat *in vacuo*.

Owing to the height of the centre of suspension of the pendulum from the stand of the apparatus, the slightest deviation from the perpendicular made an appreciable difference in the distance of the weight from the spring, and thereby increased or diminished the effect of radiation. Thus the tread of a person across the floor of the laboratory, or the passage of a cart along the street, would cause the image of the edge of the magnesium weight apparently to move from the cross wires in the telescope.

Many of these sources of error could have been removed, but in the meantime having devised a form of apparatus which seemed capable of giving much more accurate results, I ceased experimenting with the pendulum.

Before proceeding to describe the apparatus subsequently employed, I may mention that a candle flame brought within a few inches of the magnesium weight, or its image focused on the weight and alternately obscured and exposed by a piece of card at intervals of one second, will soon set the pendulum in vibration when the vacuum is very good. A ray of sunlight allowed to fall once on the pendulum immediately sets its swinging. The [illegible] apparatus above described exhibited, and experiments shown with it, at the Royal Society, April 22nd, 1874, and also before the Physical Society, June 20th, 1874.

[illegible]

[illegible] first instance becomes green, still remaining transparent. [illegible] dark green powder falls.

[illegible]

Chromium .. .. 29·8
Arsenic .. .. 42·7
Oxygen by diff. .. .. .. 27·5
100·0

This agrees very closely with the formula $CrAsO_4$, which would be—

Chromium .. .. 30·0
Arsenic .. .. 42·8
Oxygen .. .. 27·2
100·0

I think we may reasonably conclude that the powder is an arsenite of chromium. I am now engaged in preparing a further quantity of it (having only prepared a small quantity on the former occasion) with a view to further investigation.

Chemical Laboratory, Owens College.
Wright's Lane, Kensington.

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS
DURING THE LAST TEN YEARS.*
By Dr. A. W. HOFMANN.

Continued from p. 211.

Chlorine, Bromine, Iodine, and Fluorine.
By Dr. E. Mylius of Lüdenscheid.

G. Langbein reports that he has introduced another process in the works of the firm Gildemeister and Co., as the process of Tessié du Motay disregards the iodine existing as sodium iodide along with the iodic acid. This does not, however, apply to the more recent method of Thiercelin, since iodic acid is very readily decomposed by nitrous acid.

The compounds of iodine find little application in manufactures, and are therefore merely produced on a small scale. Proposals for improved methods of preparation are therefore [illegible] interest and require but a very brief notice.

For the preparation of the iodides of potassium, calcium, and lithium Liebig† proposes to form a solution of phosphoric and hydriodic acids by the reaction of amorphous phosphorus, iodine, and water, and to saturate the acid liquid with caustic baryta. Phosphate of baryta is precipitated and iodide of barium remains in solution, from which Pettenkofer) any desired iodide may be obtained by precipitation by means of a sulphate. In preparing calcic iodide the acid may be neutralised with milk of lime.

Rud Wagner‡ proposes to form the iodides by decomposing sulphites with iodine. For this purpose the [illegible] barium and decomposing the sulphide thus obtained with [illegible]

[illegible] year 1867 have proved fruitless. Amongst such we may remember the proposal of Weldon to prepare soda by

[illegible]

means of hydrofluoric acid. A solution of sulphate of soda was decomposed by means of hydrofluoric acid, obtained either by heating a mixture of magnesium fluoride and sulphuric acid, or by decomposing sodium fluoride with superheated steam. The sulphate of soda was thus to be resolved into bisulphate, which remains in solution, and natrium fluoride, which separates out. This latter salt is either converted into hydrofluoric acid and hydrate of soda by means of superheated steam or converted into hydrate of soda and magnesium fluoride by the addition of magnesia. The magnesia necessary for this purpose is obtained by heating common salt with Epsom salt ($MgSO_4+H_2O$), forming magnesia, hydrochloric acid, and sulphate of soda, which latter, as above mentioned, serves for the preparation of the sulphate of soda. The magnesium fluoride formed by decomposing the sodium fluoride with magnesia serves for the preparation of hydrofluoric acid, being heated along with the acid sulphate of soda obtained in the first operation, and thus converted into sulphates of magnesia and soda and hydrofluoric acid, the latter being again applicable for the decomposition of sulphate of soda. Thus all the materials required for the manufacture of soda are regenerated, and merely the common salt and the fuel are consumed. According to the inventor the cost of plant, fuel, &c., is smaller than in Le Blanc's process. As a shorter process Weldon suggests to convert common salt at a red heat into sulphate of soda and hydrochloric acid by means of bisulphate of soda. The sulphate of soda is then dissolved in water, and split up into sodium fluoride and bisulphate of soda by means of hydrofluoric acid, and from the sodium fluoride the hydrofluoric acid is recovered by treatment with superheated steam, hydrate of soda being the final product of this series of reactions. Notwithstanding the alleged remunerative nature of these processes neither of them has found its way into practice.

(To be continued.)

ON THE

CALCULATION OF THE RESULTS OBTAINED FROM THE ANALYSES OF SUPERPHOSPHATES, MANURES, &c.

By R. C. WOODCOCK, F.C.S.,
Royal Agricultural College, Cirencester.

THERE are probably few substances met with during the ordinary course of commercial analyses that require a more tedious set of calculations than a superphosphate. Having frequently to do these calculations, I was induced to make up the following set of tables, which give the required result (with great accuracy) in a far shorter time than when the ordinary method is adopted; the chances of a mistake are also greatly reduced. For every fraction of a grm. of the various precipitates obtained, the substance sought may at once be found by looking under its number in the table, and removing the decimal point as the case may require. An example is given, which I trust will at once make the matter quite clear, and show the shortness of the method:—

Calculations for a Superphosphate.

P_2O_5 soluble in cold water, existing as $CaH_4P_2O_8$.

1 grm. gave 0·1995 $Mg_2P_2O_7$ = 19·95 per cent $Mg_2P_2O_7$.

Required, the per cent of $CaH_4P_2O_8$:—

10·00	=	10·5405000
9·00	=	9·4864500
0·90	=	0·9486450
0·05	=	0·0527025
19·95	=	21·0282975 $CaH_4P_2O_8$.

Required, water lost by the $CaH_4P_2O_8$ on ignition, to be subtracted from the total loss on ignition, which would otherwise be counted as "organic matter and combined water":—

10·00	=	1·6216000
9·00	=	1·4594400
0·90	=	0·1459440
0·05	=	0·0081080
19·95	=	3·2350920 OH_2 in 19·95 $CaH_4P_2O_8$.

Insoluble P_2O_5 existing as $Ca_3P_2O_8$, obtained by subtracting the soluble P_2O_5 ($Mg_2P_2O_7$) from the total quantity, *i.e.*, the portion dissolved in HCl.

1·1045 grms. gave 0·2595 $Mg_2P_2O_7$.

1·1045 : 0·2595 :: 100 : x = 23·49 p.c. total $Mg_2P_2O_7$
19·95 „ soluble „
3·54 „ insoluble „

Required the per cent of $Ca_3P_2O_8$:—

3·00	=	4·1891700
0·50	=	0·6981950
0·04	=	0·0558556
3·54	=	4·9432206 $Ca_3P_2O_8$.

1·1045 grms. gave 0·508 $CaCO_3$.

Required the per cent of $CaSO_4$:—

1·1045 : 0·508 :: 100 : x = 45·99 per cent $CaCO_3$.

$CaCO_3$ to be deducted from the total quantity, for Ca contained in $CaH_4P_2O_8$:—

Found.	Sought.	1.	2.	3.	4.	5.	6.	7.	8.	9.
$Mg_2P_2O_7$	$CaH_4P_2O_8$	1·05405	2·10810	3·16215	4·21620	5·27025	6·32430	7·37835	8·43240	9·48645
Do.	$Ca_3P_2O_8$	1·39639	2·79278	4·18917	5·58556	6·98195	8·37834	9·77473	11·17112	12·56751
Do.	$CaCO_3$ for $CaH_4P_2O_8$	0·45045	0·90090	1·35135	1·80180	2·25225	2·70270	3·15315	3·60360	4·05405
Do.	$CaCO_3$ for $Ca_3P_2O_8$	1·35135	2·70270	4·05405	5·40540	6·75675	8·10810	9·45945	10·81080	12·16215
Do.	OH_2 in $CaH_4P_2O_8$	0·16216	0·32432	0·48648	0·64864	0·81080	0·97296	1·13512	1·29728	1·45944
Do.	P_2O_5	0·63964	1·27928	1·91892	2·55856	3·19820	3·83784	4·47748	5·11712	5·75676
P_2O_5	$CaH_4P_2O_8$	1·64789	3·29578	4·94367	6·59156	8·23945	9·88734	11·53523	13·18312	14·83101
Do.	$Ca_3P_2O_8$	2·18310	4·36620	6·54930	8·73240	10·91550	13·09860	15·28170	17·46480	19·64790
Do.	$CaCO_3$ for $CaH_4P_2O_8$	0·70422	1·40844	2·11266	2·81688	3·52110	4·22532	4·92954	5·63376	6·33798
Do.	$CaCO_3$ for $Ca_3P_2O_8$	2·11268	4·22536	6·33804	8·45072	10·56340	12·67608	14·78876	16·90144	19·01412
Do.	OH_2 in $CaH_4P_2O_8$	0·25352	0·50704	0·76056	1·01408	1·26760	1·52112	1·77464	2·02816	2·28168
$CaCO_3$	$CaSO_4$	1·36000	2·72000	4·08000	5·44000	6·80000	8·16000	9·52000	10·88000	12·24000
$PtCl_4$·2KCl	K_2O	0·19287	0·38574	0·57861	0·77148	0·96435	1·15722	1·35009	1·54296	1·73583
$PtCl_4$·2AmCl	Am_2SO_4	0·29583	0·59166	0·88749	1·18332	1·47915	1·77498	2·07081	2·36664	2·66247

10·00	=	4·5045000
9·00	=	4·0540500
0·90	=	0·4054050
0·05	=	0·0225225
19·95	=	8·9864775 $CaCO_3$.

$CaCO_3$ to be deducted from the total quantity, for Ca contained in $Ca_3P_2O_8$:—

3·00	=	4·0540500
0·50	=	0·6756750
0·04	=	0·0540540
3·54	=	4·783779 $CaCO_3$

8·99 $CaCO_3$ for 21·03 $CaH_4P_2O_8$
4·78 " " 4·94 $Ca_3P_2O_8$

13·77 total $CaCO_3$ to be deducted.

45·99 per cent total $CaCO_3$
13·77

32·22 $CaCO_3$ existing as $CaSO_4$.

30·00	=	40·8000
2·00	=	2·7200
0·20	=	0·2720
0·02	=	0·0272
32·22 $CaCO_3$		43·8192 $CaSO_4$.

It is possible that many chemists would rather calculate out their results by the ordinary method than trust to any tables to do the work for them; but even to these I feel sure they will be of service, if only used to check the calculations.

I have calculated the amounts of various substances ($CaH_4P_2O_8$, &c.) which correspond to found amounts of $Mg_2P_2O_7$, and those which correspond to given amounts of P_2O_5; for in some cases it may be convenient to calculate out the P_2O_5 at once. I may mention that the "atomic weight" of calcium is taken as 40, and that of platinum as 197·2. $PtCl_42KCl$ is calculated into K_2O and $PtCl_42AmCl$ into Am_2SO_4.

It will be seen that these tables are arranged in a similar manner to those given by Fresenius, for the calculation of various substances found, into their required results.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, November 16th, 1876.

Professor ABEL, F.R.S., President, in the Chair.

AFTER the names of the visitors had been announced, and the minutes of the previous meeting read and confirmed, the names of Messrs. Edward Horatio Walker Sweete and Channell Law were read for the third time. They were then ballotted for and duly elected.

The first paper, "*On Barwood*," by the late Professor ANDERSON, was then read by the SECRETARY. On extracting barwood successively with ether and with alcohol, and evaporating the solution, a crystalline compound, *baphnin*, $C_{24}H_{20}O_8$, is obtained, together with amorphous substances of a red colour. When baphnin in alcoholic solution is treated with acetate of lead, a white precipitate of lead baphate is obtained, together with *baphnitin*, $C_{21}H_{22}O_6$, which remains in solution. A similar decomposition takes place on submitting baphnin to the action of a solution of potassic hydrate. *Baphic acid*, $C_{24}H_{22}O_{10}$, may be obtained from the lead precipitate by decomposing it with sulphuretted hydrogen. The author also obtained another compound, *baphinitone*, $C_{24}H_{26}O_6$, which by the action of bromine yields a [illegible] derivative, $C_{24}H_{23}Br_3O_6$.

The PRESIDENT having thanked Dr. E. J. Mills for communicating this paper to the Society,

Dr. C. R. A. WRIGHT gave a short abstract of Part I. of his memoir on "*The Alkaloids of the Aconites: on the Crystallisable Alkaloids contained in* Aconitum Napellus." After referring to his preliminary notice on the subject (containing an account of *pseudo-aconitine*, $C_{36}H_{49}NO_{11}$, the uncrystallisable alkaloid of *A. ferox*, which, however, yields well-defined crystallisable salts) he stated that very different results were obtained with *A. Napellus*. In one batch of 1 cwt. of roots, which were worked up, two alkaloids were found, one of which, existing in comparatively small quantity, readily crystallised from ether, whilst the other did not. The latter, however, yielded crystalline salts, which have a bitter taste, but do not produce the peculiar prickling of the tongue so characteristic of aconite roots. This base, which is comparatively inert, may be called *picraconitine*, $C_{31}H_{45}NO_{10}$. The crystalline base *aconitine*, $C_{33}H_{43}NO_{12}$, which possesses high physiological activity, can only be obtained pure after repeated crystallisation, first in the free state, and then as a salt, finally liberating the base by ammonia or an alkaline carbonate. In a second quantity of 2 cwts. of the roots worked up to a condensed extract by Messrs. Hopkin and Williams according to Duquesnel's process, only one crystallisable alkaloid, aconitine, was found. The hydrochloride, hydrobromide, and gold salt of this base, all of which are crystalline, were prepared and carefully examined.

The PRESIDENT thanked the author for this communication on a subject so important, both from a chemical and medical point of view, and hoped that he would soon lay before them the results of his experiments on the changes produced on the alkaloid by various reagents.

Mr. DAVID HOWARD remarked that it was a point of peculiar interest to ascertain how far the difference in the alkaloids was due either to diversity of species or to diversity of growth, occasioned by difference of climate or soil.

Mr. W. N. HARTLEY, Mr. C. E. GROVES, and Mr. W. H. PERKIN called the attention of the members to marked differences produced in plants from circumstances of climate, soil, season of collecting, &c., which had come within their personal experience.

Mr. J. WILLIAMS said he had every reason to believe that the different batches of roots employed had grown wild in Switzerland, and were even from the same bale. He was of opinion that the different results obtained were due to alterations in the process. In the first extraction a stronger acid was used: it was heated for a longer time, and having been made much more dilute had to be concentrated more. It was not improbable that the picraconitine was really an alteration-product of the aconitine.

Dr. WRIGHT replied that he had at first been inclined to believe that picraconitine was an alteration-product formed by the action of hydrochloric acid on the aconitine, but Mr. Groves, of Weymouth, on extracting different samples of the roots by the same process, had in one instance obtained picraconitine, whilst in others it was not found. It would be interesting to ascertain if any alkaloid could be obtained from the marc. It was possible that the aconite existed in the extract in the form of a compound similar to a glucoside.

The next paper was by Mr. G. S. JOHNSON, "*On Potassium Tri-iodide*." This was obtained by dissolving iodine to saturation in an aqueous or alcoholic saturated solution of potassium iodide, and evaporating slowly over sulphuric acid. At first potassium iodide is deposited in cubes coloured by free iodine, but these, after some days, are succeeded by lustrous prismatic crystals of the tri-iodide KI_3, resembling iodine in appearance. It is very deliquescent, and is decomposed by water with liberation of

odine, but may be crystallised from alcohol. Two fine specimens of the crystals were exhibited.

The last communication was "*On the Coal-Gas of the Metropolis*," by Mr. T. S. D. Humpidge. The gases examined were those of the Imperial, five of the Chartered, collected at different stations, and the cannel-gas supplied to the Houses of Parliament, all during the month of May, 1876. The illuminating power was taken, and the gases carefully analysed, determinations being made of the carbonic anhydride, oxygen, nitrogen, marsh-gas, carbonic oxide, and the hydrocarbons absorbed by sulphuric anhydride. From a comparison of the results with those obtained by Dr. Frankland in 1851 (twenty-five years ago), the author is of opinion that the gas now delivered in London is no better than it was then, and that the increase in the illuminating power announced from the various testing stations is to be attributed to improvements in the test-burner; a comparison of the present referees' test-burner with that used prior to 1860 showing a difference of more than three candles.

Dr. Frankland remarked that it seemed rather a melancholy fact, that although Parliament had spent much time and trouble on the matter, and had raised the standard from 14 to 16 candles, yet substantially the gas was the same as in 1851, and we were actually no better off now than we were then.

Mr. W. Valentin said most of the photometric observations had been made in the morning or in the afternoon, when the gas was perhaps not so good as it was in the evening, the time when the Act of Parliament provides that it should come up to the standard of 16 candles. Some, at all events, of the percentage of hydrocarbons was due to naphthalene, and not to oiefines or benzene. This was a source of great inconvenience, by causing obstructions in the service-pipes, &c.

In reply to a question by Mr. Vernon Harcourt, Dr. Frankland said that in his experiments he had found that for a given quantity of hydrocarbon vapour, diluted with a mixture of marsh-gas and hydrogen, the illuminating power was sensibly the same whether the diluent contained 60, 25, or only 15 per cent of marsh-gas, from which he concluded that marsh-gas was as much without illuminating power as hydrogen. There could be no doubt that benzene gave a very much higher illuminating power than hydrocarbons of the $C_n H_{2n}$ and $C_n H_{2n+2}$ series, but he could not understand Berthelot's statement that coal-gas owed its illuminating power chiefly to benzene. Although this might be true of the Paris gas, it certainly was not of the London gas. He might state that all the gases mentioned in his report in 1851 were collected in the daytime, and the photometric power determined in the day. On reference to Mr. Humpidge's results it would be seen that one of his determinations, made at 9.30 a.m., came fully up to the standard, as it was 16·3. He thought the most important point in the paper was that it showed that the apparent increase in illuminating power was really due to the improvement of the test-burner, which with the same gas gave a light of 16 candles instead of 13 as the old one did.

Mr. Wills said his experience did not bear out the statement that the gas was no better now than it was twenty-five years ago. He was in the habit of examining the gas made by several of the large companies. They now supplied a gas up to the standard of 16 candles instead of 12 candles as in 1851. Of this increase only two candles was due to improvement in the burner, and not three as stated by Mr. Humpidge, leaving a clear gain of two candles.

The President, after some remarks on the gas manufactured at Woolwich by the Government, adjourned the meeting until Thursday, December 7, when the following papers will be read:—(1) "Analysis of a Species of Erythrophyll," by Prof. Church; (2) "On Phenylendiamin," by Dr. Otto Witt: (3) "On Calcium Sulphate," by Mr. Hannay.

PHYSICAL SOCIETY.

November 18th, 1876.

Professor G. C. Foster, F.R.S., President, in the Chair.

The following candidates were elected members of the Society:—Major W. Malcolm, R.E.; Prof. J. M. Purser; Dr. W. Francis; Mr. G. Johnstone Stoney; and Mr. D. MacAlpine.

Mr. Tylor read a paper on the "*Cohesion and Capillary Action of Films of Water under Various Conditions.*" The author endeavours to eliminate the action of all forces except that of gravity by immersing his "valves" in water. The models which he exhibited consisted of glass tubes, about 3 inches in diameter and 6 inches high, filled with water, and containing each a piston, which, on being raised, was capable of lifting by cohesion a heavy mass of metal, the nature of the surfaces in contact differing in the several instruments. From experiments with them he concludes that the time during which a heavy valve can be supported depends upon the size of the surface of contact, the difference of pressure within and without the moving parts, and the smoothness of the valve. On the contrary, dry bodies—such as Whitworth's surface planes—will adhere for an indefinite period. Mr. Tylor considers that the supporting of a body in water is due to a difference of pressure in the water itself, and he adduced Giffard's injector as showing that such differences can take place. He has also studied the form assumed by a drop of water at a tap, and considers that when a fly walks on a ceiling its weight acts in the same manner as the heavy valves in the models exhibited.

Prof. Shelley exhibited some of Sir Joseph Whitworth's surface planes and gauges, and showed their bearing on the subject.

Dr. Stone then projected on to the screen the spectra produced by the diffraction gratings which he exhibited at the last meeting of the Society. When received on a screen at a distance of about 25 feet they showed bright bands in the red and violet after transmission through a strong solution of permanganate of potash. Mr. Clark has since ruled for him gratings on the backs of right-angled prisms, and Dr. Stone has cemented—by means of glycerin or oil of cassia—gratings on glass and steel on such prisms. The lines were two thousand and three thousand to the inch.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, October 3rd, 1876.

Rev. William Gaskell, M.A., in the Chair.

"*On the Action of Water and [illegible] on Lead*," Part II., by M. M. Pattison Muir, F.R.S.E., Assistant Lecturer on Chemistry, Owens College.

1. I have already in several places* described the results of various series of experiments, undertaken with a view to arrive at definite measurements of the solvent action of dilute saline solution upon lead, and to ascertain the circumstances which condition this action. The general results of these experiments may be summed up as follows:

(1.) *Nitrates* [illegible] to exhibit a very marked solvent action upon lead.

(2.) *Carbonates, sulphates, and chlorides* greatly diminish the solvent action of water upon lead.

(3.) These three salts, *along with nitrates*, greatly decrease or even stop the solvent action exercised by the nitrates when present alone.

* Proc. Glasgow Phil. Soc., 1874-75, 194; Nat. Sci. Congress, 1874; Manchester Lit. and Phil. Soc., 1875, [illegible]

(4.) The amount of lead increases with the length of time during which the water remains in contact with the lead.

(5.) Water charged with carbon dioxide exercises no very marked solvent action upon lead, but when the water is charged with the gas under pressure the solvent action is very greatly increased.

2. These or similar general conclusions had been arrived at by previous experimenters; but I have been able to give a considerable series of actual measurements of the amount of action exercised by the various solutions upon given surfaces of lead under stated conditions.

3. In carrying out the experiments alluded to above I was often struck by apparent discrepancies in the results

A.—EXPERIMENTS CARRIED OUT IN CORKED FLASKS NEARLY FILLED WITH LIQUID, 500 cbc. IN EACH.

Nature of Solution.	Grms. per Litre.	Surfaces of Lead Exposed in sq. cm.	Total Lead in Milligrms. in Solution in the Liquid after— 42 hours.	68 hours.	70 hours.	135 hours.	140 hours.	168 hours.	336 hours.	340 hours.	505 hours
Distilled water	—	25	0·7	—	—	—	—	—	—	1·2	1·5
,, ,,	—	50	0·7	—	—	—	—	—	—	0·9	1·0
,, ,,	—	60	—	0·5	0·5	0·8	0·8	—	—	—	—
,, ,,	—	120	—	0·2	0·2	0·4	0·4	—	—	—	—
Potassium nitrate	0·132	60	—	0·5	0·5	0·7	—	—	—	—	—
,, ,,	,,	120	—	0·2	—	0·4	—	—	—	—	—
,, ,,	,,	240	—	—	0·1	—	—	—	—	—	—
,, ,,	0·232	60	—	—	0·7	—	—	—	—	—	—
,, ,,	0·200	25	0·7	—	—	—	—	—	—	1·2	1·6
,, ,,	,,	50	1·0	—	—	—	—	—	—	1·2	1·5
Ammonium nitrate	0·200	25	0·9	—	—	—	—	—	—	1·8	1·8
,, ,,	,,	50	1·4	—	—	—	—	—	—	1·5	1·5
Calcium chloride	0·132	60	—	0·4	0·4	0·7	—	—	—	—	—
,, ,,	,,	120	—	0·2	0·2	0·4	—	—	—	—	—
,, ,,	,,	240	—	0·15	—	—	—	—	—	—	—
,, ,,	0·200	25	—	—	—	—	—	1·3	1·8	—	3·0
,, ,,	,,	50	—	—	—	—	—	2·0	2·5	—	2·5
,, ,,	0·232	60	—	—	0·7	—	—	—	—	—	—
Potassium carbonate	0·200	25	—	—	—	—	—	traces	0·3	—	0·3
,, ,,	,,	50	—	—	—	—	—	,,	0·3	—	0·3
Ammonium sulphate	0·200	25	—	—	—	—	—	0·5	0·7	—	0·7
,, ,,	,,	50	—	—	—	—	—	0·7	0·7	—	0·7

B.—EXPERIMENTS CARRIED OUT IN BEAKERS HALF FILLED WITH LIQUID (500 cbc.) AND COVERED WITH UNSIZED PAPER; DIAMETER OF MOUTH OF BEAKER = 11·5 cm.

Distilled water	—	25	0·4	—	—	—	—	—	0·5	0·8
,, ,,	—	50	0·4	—	—	—	—	—	1·2	1·8
,, ,,	—	120	—	1·0	1·0	1·2	1·2	—	—	—
,, ,,	—	240	—	1·2	1·2	—	—	—	—	—
Potassium nitrate	0·132	120	—	1·0	1·0	1·2	—	—	—	—
,, ,,	,,	240	—	1·2	1·2	—	—	—	—	—
,, ,,	0·200	25	0·4	—	—	—	—	—	0·4	0·5
,, ,,	,,	50	0·6	—	—	—	—	—	2·2	2·5
,, ,,	0·232	120	—	—	1·2	—	—	—	—	—
Ammonium nitrate	0·200	25	0·4	—	—	—	—	—	2·0	4·0
,, ,,	,,	50	0·8	—	—	—	—	—	3·5	4·0
Calcium chloride	0·132	120	—	1·3	1·3	1·5	—	—	—	—
,, ,,	,,	240	—	—	1·2	—	—	—	—	—
,, ,,	0·200	25	—	—	—	—	—	1·3	1·5	—	2·8
,, ,,	,,	50	—	—	—	—	—	2·0	3·0	—	3·5
,, ,,	0·232	120	—	—	1·5	—	—	—	—	—	—
Potassium carbonate	0·200	25	—	—	—	—	—	0·2	0·3	—	0·3
,, ,,	,,	50	—	—	—	—	—	0·2	0·3	—	0·3
Ammonium sulphate	0·200	25	—	—	—	—	—	0·7	1·0	—	1·3
,, ,,	,,	50	—	—	—	—	—	0·7	1·0	—	1·5

C.—EXPERIMENTS CARRIED OUT IN BASINS FULL OF LIQUID (500 cbc.) AND COVERED WITH UNSIZED PAPER. DIAMETER OF MOUTH OF BASIN = 14·5 cm.

Distilled water	—	25	0·6	—	—	—	—	—	2·0	4·2
,, ,,	—	50	0·8	—	—	—	—	—	1·5	3·5
,, ,,	—	120	—	—	1·5	—	—	—	—	—
Potassium nitrate	0·132	120	—	—	1·5	—	—	—	—	—
,, ,,	0·200	25	0·8	—	1·6	—	—	—	2·8	6·0
,, ,,	,,	50	1·1	—	—	—	—	—	2·8	3·5
Ammonium nitrate	0·200	25	1·0	—	—	—	—	—	8·0	16·0
,, ,,	,,	50	1·3	—	—	—	—	—	10·0	16·0
Calcium chloride	0·132	120	—	—	1·8	—	—	—	—	—
,, ,,	0·200	25	—	—	—	—	—	2·0	3·0	—	5·5
,, ,,	,,	50	—	—	—	—	—	2·5	3·5	—	4·5
Potassium carbonate	0·200	25	—	—	—	—	—	0·5	0·7	—	0·7
,, ,,	,,	50	—	—	—	—	—	0·7	0·9	—	0·9
Ammonium sulphate	0·200	25	—	—	—	—	—	2·5	9·0	—	16·0
,, ,,	,,	50	—	—	—	—	—	2·5	7·5	—	12·0

D.—EXPERIMENTS CARRIED OUT IN CORKED FLASKS NEARLY FILLED WITH LIQUID (500 cbc.) THROUGH WHICH A STREAM OF AIR WAS CONTINUALLY PASSED.

Nature of Solution.	Grms. per Litre.	Surfaces of Lead Exposed in sq. cm.	Total Lead in Milligrms. in Solution in the Liquid after								
			42 hours.	68 hours	70 hours.	138 hours.	140 hours.	168 hours.	336 hours.	340 hours.	505 hours.
Distilled water	—	25	—	—	—	—	—		—	1·5	2·0
Potassium nitrate	0·132	25	—	—	—	—	—	—	—	1·2	1·5
,, ,, ...	,,	240	—	0·8	—	—		—	—	—	—
Calcium chloride	0·200	25	—	—	—	—	—	3·5	3·5	—	3·5
,, ,, ...	,,	50	—	—	—	—	—	0·5	0·5	—	? 0·5
Potassium carbonate	,,	25	—	—	—	—	—	0·4	0·6	—	0·6
,, ,, ...	,,	50	—	—	—	—	—	0·5	0·5	—	0·5
Ammonium sulphate	,,	25	—	—	—	—	—	1·3	3·0	—	5·0
,, ,, ...	,,	50	—	—	—	—	—	0·7	1·3	—	2·5

E.—EXPERIMENTS CARRIED OUT IN BEAKERS HALF FILLED WITH LIQUID (500 cbc.) AND COVERED WITH UNSIZED PAPER: DIAMETER OF MOUTH OF BEAKER = 11·5 cm. THE LEAD WAS SUSPENDED IN THE LIQUID SO THAT AN AMOUNT OF SURFACE, EQUAL TO THAT IMMERSED, WAS EXPOSED TO THE AIR.

Calcium chloride	0·200	25	—	—	—	—	—	1·4	2·5	—	3·5
,, ,, ...	,,	50	—	—	—	—	—	2·1	3·5	—	4·0
Potassium carbonate	,,	25	—	—	—	—	—	traces	0·2	—	0·3
,, ,, ...	,,	50	—	—	—	—	—	0·5	0·7	—	0·7
Ammonium sulphate	,,	25	—	—	—	—	—	0·8	1·5	—	2·5
,, ,, ...	,,	50	—	—	—	—	—	1·0	2·0	—	3·5

obtained; hence I was led to the belief that the action of dilute saline solution upon lead is one which may be very materially altered by what appear at first sight to be slight alterations in the conditions of the action. The object of the experiments detailed in the present paper was, if possible, to determine more narrowly what these conditions are. The questions to which I shall endeavour at present to give answers, partial though they must be, are these:—Does the amount of lead dissolved increase with increase of surface exposed to the action of the solvent? Does the free admission of air to the surface, or the passage of air through the body of the liquid influence the quantity of lead dissolved? Do the solvent actions of dilute saline solution upon lead continue during lengthened periods, or is there a limit reached after which little or no further action is exercised upon the lead?

4. And, in the first place, does the amount of lead dissolved increase with increase of surface exposed to the action of the solvent? In order to obtain an answer to this question experiments were carried out with the same solvent, but with varying surfaces of lead exposed, and under somewhat varying conditions of action.

The results of these experiments are presented in Table I.

These results do not point to a regular increase of lead dissolved associated with increase of surface exposed. In certain cases the amount of lead dissolved does increase most notably as the surface exposed is increased, but in other cases it diminishes. The other conditions affecting the solvent action appear to exercise a disturbing influence upon that one condition, the action of which it was desired to trace. Thus in the case of distilled water, whether the surface of lead exposed measured 25 or 50 sq. cm. when the action was allowed to proceed for 42 hours, the amount of lead dissolved was the same, nor did carrying out the experiment in a corked flask, a beaker, or a basin loosely covered with porous paper, materially affect the result. But when the action had proceeded for 340 hours, the conclusions to be drawn are found to be very considerably affected by the nature of the vessel employed. In closed flasks the amount of lead dissolved slightly decreased with increase of surface exposed; in beakers there was a very marked increase in lead dissolved with increase of surface exposed, while in basins again increase of surface was associated with decrease of solvent action. By looking at the experiments carried out in corked flasks I think it would be altogether unwarrantable to say that an increase of surface exposed is generally associated with an increase in quantity of lead dissolved. From the experiments carried out in beakers half filled with liquid and covered with porous paper I think the conclusion may be deduced that there is *generally* an increase of solvent action with increase of exposed surface; this is especially evident in the case of those salts which increase the solvent action (nitrates, &c.) and after the lapse of considerable periods of time—300 to 500 hours. The results of the experiments carried out in basins do not permit me to draw any general conclusion on the subject now under consideration; there is sometimes an increase, at other times a decrease, in the amount of lead dissolved associated with a fixed increase in surface exposed. It would almost appear as if exposure of the liquid to large surfaces of air was less fitted to promote solvent action than exposure to smaller surfaces of air. And the experiments carried out in flasks through which a stream of air continually passed seem to countenance some such conclusion as this. In these experiments there was invariably a diminution in the quantity of lead dissolved associated with an increase in the surface exposed. It is only in the last set of experiments carried out in beakers half filled with water, and loosely covered, and having one half of the lead immersed in the liquid and the rest exposed to the air—that an increase in lead dissolved is invariably associated with increase of surface exposed. So far as the first inquiry is concerned these experiments do not warrant the assumption of an invariable increase in the quantity of lead dissolved associated with an increase in the surface of lead exposed to the action of the solvent.

(To be continued.)

NOTICES OF BOOKS.

Practical Portrait Photography, &c. By WILLIAM HEIGHMAN. London: Piper and Carter.

THIS little work would have been a much more satisfactory performance had the author recollected its title and confined himself entirely to the manipulatory portion of photography, which he has treated capitally, instead of constantly interlarding his practical directions with *dicta* on the chemistry of the subject, which only serve to show once more that "a little learning is a dangerous thing." Mr. Heighman is evidently an expert manipulator who has pursued photography much more as an art than a science: hence his descriptions of the various processes and his remarks on the artistic part of the matter are all that can be desired. The chapters on "Photographic

Æsthetics," "Expression," "Pose," "Illumination," and "Retouching," might be studied with advantage by many even of our first-class photographers, who are only too frequently deficient in artistic taste and feeling. With this part of the book, however, we have but little concern.

The numberless formulæ published in the columns of our photographic contemporaries, which are generally the invention of some enthusiastic amateur who wants to make his name famous, have long since become so bewildering to the professional photographer who is desirous of improving his art to the utmost, that a work like the present, giving new and tried recipes, will be warmly welcomed by him. The practical worker now-a-days has no time for trying experiments; the consequence is that a new formula or the improvement of an old one is quite a rarity in the annals of photography. These remarks apply with still greater force to the amateur, who, as a rule, is too much given to run after worthless novelties in the way of sensitising baths and developing solutions. Mr. Heighman's remarks on precision and cleanliness will be found most valuable to all classes of photographers. The author himself is apparently excessively precise and cleanly in manipulation, and we question whether some of his methods would succeed with the hurried professional or careless amateur. His recommendation to coat the glass plate with ammoniated albumen before coating it with collodion would, we fear, prove a failure in most cases. With great perfection of manipulation, no doubt, the albumen and ammonia will not injure the silver-bath, but perfection is not attained by everybody. The arrangement of the dark room is more fully dwelt upon than in most manuals of the kind, but the directions for doctoring spoilt and worn-out baths are too complicated for general practice. An odd omission, too, occurs in the remedy for a too acid bath. Liquor ammoniæ is to be dropped in until a black precipitate is formed, but nothing is said about subsequent filtration and acidification, without which the bath would be distinctly alkaline. In the directions for making a negative bath the learner is told to dissolve silver nitrate in water, to iodise it in the usual manner, after which it is to be filtered and made alkaline with liquor ammoniæ; it is then exposed to the sunlight, when it deposits "organic matter as thick mud at the bottom of the bottle!" May we ask Mr. Heighman whence this organic matter comes? At page 22 the author states that "the effect of acid in the bath is to decompose any organic matter present in the solution," whereas at page 28 he says that "acid holds the organic matter in solution." Surely Mr. Heighman's ink must have been strongly *alkaline* when he wrote this portion of his manual.

The style of the book is, to say the least of it, eccentric. "Graduate" for graduated measure, "flow" for pour or coat, and "skylight" for glass room, are certainly not Queen's English. We hope to see another edition of this really useful work, but divested of all such defects as we have pointed out. There are also several misprints that ought to be corrected, such as "hyposulphate" for "hyposulphite," "liquor ammonia" for "ammoniæ."

The Journal of the Iron and Steel Institute, 1876. London: E. and F. N. Spon.

This issue contains the respective discussions on Mr. Sandberg's paper on "The Strength of Rail Joints," and on Mr. Snelus's paper on "Fire-Clays and other Refractory Materials." In this latter much weight was laid on the importance of an accurate determination of potash and soda, the constituents which mainly imparted a fusible character to clays. There is also a discussion on the "Use of Molten Iron Direct from the Blast-Furnace for Bessemer Purposes;" and papers on the "Uses of Ferro-Manganese," by M. F. Gautier, of Paris; on the "Ferroux Rock Drill and Air Company," by Mr. H. W. Pendred; and on "Carbon and other Deposits from the Gases of Blast-Furnaces in Cleveland," by Mr. J. Pattinson. It appears that the fire-brick lining of certain blast-furnaces, even in the upper part, was strikingly disintegrated. On analysis it was found that carbon had been deposited within the texture of the bricks to the extent of from 2·05 to 5·97 per cent, whilst the proportion of potash present, amounting to 2·60 per cent in the original brick, was increased in one case to 7·54 per cent.

The issue further contains papers on the "Casson-Dormey Puddling Furnace," by Mr. E. F. Smith; on "Cleveland Steel Rails;" on "Overcoming Steep Gradients on Railways," by Mr. H. Handyside;" "Notes on Iron-Ore Deposits at Naeverhaugen, Bodœ, Norway," by Mr. Thorsten Nordenfelt;" on "Improved Casting Arrangements for the Siemens-Martin Process," by Mr. Michael Scott; together with "Reports on the Progress of the Iron and Steel Industries in Foreign Countries and in the United Kingdom.

CORRESPONDENCE.

THE SOCIETY OF PUBLIC ANALYSTS.

To the Editor of the Chemical News.

Sir,—The time has arrived when those members who, like myself, consider that the present editorship is compromising the Society of Public Analysts have to choose between making a change in the editorship and retiring from the Society. The irregularities in the Society, and the want of vitality shown by the scantiness of the attendance at the ordinary meetings, and by other unmistakable signs, discourage the effort to attempt a reformation, and, following the example of our Treasurer, I am adopting the easier course of retiring from the Society. I have laid down my office of Vice-President, and ceased to be a member of the Society of Public Analysts.—I am, &c.,

J. Alfred Wanklyn.

11, Charlotte Street, Fitzroy Square, London, W.
November 18, 1876.

THE D-LINES SPECTRA FLAME EXAMINED BY THE BLOWPIPE.

To the Editor of the Chemical News.

Sir,—The communications of your contributor, Major Ross, are—so often as they are confined to the subject of "Pyrology"—sometimes interesting, and always amusing. But it does not seem to occur to Major Ross that when they treat of subjects "external to the pyrocone," they are not brilliantly candescent, and that they may, besides, do positive harm. For it is not impossible to suppose that among the readers of the Chemical News there may be numbered some who may think that, notwithstanding the accumulated evidence to the contrary, Major Ross has raised a reasonable doubt that the D-lines in the spectrum are produced, not by sodium, but by water, and that the series of experiments which he adduces in proof are a fair specimen of the experimental method as followed by chemists; and if this be so, it may be desirable to point out—(1) That at a "white heat" the sodium salt adherent to platinum wire or foil is readily volatilised, and soon fails to afford the spectrum characteristic of sodium, while at a lower temperature—the salt being less volatile—the spectrum is more permanent. (2) That the absorption of an orange flame [*sic*] by fused boracic acid, and the consequent opacity of the latter, is *not* positive evidence of the absence of sodium in that flame.

But Major Ross, who writes as if he really believed in his own theory, will hardly, I think, gain many co-believers among scientific men unless he can demonstrate that—(*a*) A vacuum tube containing sodium on platinum points will not, on the passage of an electric spark, give the D-lines unless it also contains water; and (*b*) that water which he can prove to be free from sodium *will* give them

Before writing this I have taken great pains to understand Major Ross's paper, and I could almost say that I do so were it not for the sentence [illegible] his fifth paragraph. [illegible] failed. After experiments [illegible] of "that that" to "that" [illegible] by analysis and synthesis [illegible] "sodium hypothesis"), I have been obliged to abandon the problem.—I am, &c.,

NaHO.

ON ANTHRACENE TESTING.

To the Editor of the Chemical News.

SIR,—Mr. Caspers [illegible] anthracene testing [illegible].

Mr. Caspers is good [illegible] obtaining from me private information, an [illegible] sample of anthracene, and then utilising the same in contradicting my statements, without informing me [illegible] attention to do so. Such conduct is happily unknown in the scientific world, or there would soon be an end of all free exchange of ideas on scientific matters. But Mr. Caspers is no chemist, and I cannot discuss with him theoretical questions: his observations on my results are valueless.

Mr. Caspers, with charming simplicity, shows his ignorance of the first rudiments of chemistry when he says—"Nearly all coal-tar distillers, even those who work under the direction of efficient chemists, have unpersuadedly to believe that the *specific gravities* of quinone and anthracene are in proportion like 1000 : 856."

Apart from the mass of confused ideas compressed into a few lines, the fact clearly stands out that the writer does not know the difference between specific gravity and atomic weight, and I must simply decline to notice any future criticisms coming from such doubtful authority.—I am, &c.,

FREDERICK VERSMANN.

37, Whitecross Place, Wilson Street, Finsbury, E.C.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances, de l'Academie des Sciences. No. 19, November 6, 1876.

Researches on the Production of Electro-Chemical Deposits of Aluminium, Magnesium, Cadmium, Bismuth, Antimony, and Palladium.—M. A. Bertrand.—The author has obtained deposits of aluminium on decomposing with a strong battery a solution of the double chloride of aluminium and ammonium. A plate of copper, forming the negative pole, whitens gradually, and becomes covered with a layer of aluminium, which takes a brilliant polish under the burnisher. The double chloride of magnesium and ammonium in an aqueous solution is readily decomposed by the battery, giving in a few minutes strongly adherent and homogeneous deposits of magnesium upon a sheet of copper. It polishes readily. The battery must be powerful. Cadmium is best deposited from the bromide to which a little sulphuric acid has been added. It is then very coherent and very white, and takes a fine polish. The sulphate, if acidulated, also gives an immediate deposit of metallic cadmium, very adhesive, and capable of a fine polish. Bismuth is deposited from a solution of the double chloride of bismuth and ammonium upon copper or brass by the current from a Bunsen element. It is very adhesive; though mat, it is capable of taking a fine polish, and may be introduced in the decoration of objects of art. Antimony can be deposited from a solution of the double chloride of antimony and ammonium [illegible] serves to replace [illegible] of fine art manufactures. Deposits [illegible] connected with ease by means of the double chloride of palladium and ammonium, either with or without the battery. The solution must be perfectly neutral.

New Dynamo-Magnetic Phenomenon.—MM. Trève and Durasser.—Let there be a horse-shoe magnet, of any length, covered upon one side with varnish, or, better, with a plate of glass. If there is laid upon the neutral part a cylinder of soft iron, it is seen to move towards the poles, which it reaches in a time which is a function of the weight of the cylinder and of the coercitive force of the magnet. Hence there results a new method of estimating the magnetic force by the mechanical work which [illegible].

Detection of Magenta in Wine.—M. E. Bouilhon.—Five hundred c.c. of wine are placed in a capsule, raised to a boil, and evaporated down to 125 c.c.; the capsule is then withdrawn from the fire, and 20 grms. crystalline hydrate of baryta are added. It is agitated to facilitate the reaction, allowed to cool, poured upon a filter, and the precipitate washed with distilled water, so as to obtain in all 125 c.c. of filtrate. It is then necessary to ascertain, by the addition of a few crystals of hydrate of baryta to the filtered liquid, that the precipitation of the colouring matter of the wine is complete: if not, more hydrate of baryta must be added, and the liquid re-filtered. It is then introduced into a flask containing about 250 c.c., with 50 to 60 c.c. of pure ether, strongly shaken, and allowed to settle. When the ether is completely separated from the aqueous liquids it is drawn off by means of a pipette, and poured into a porcelain capsule. A drop of acetic acid at 8° is added, 3 or 4 drops of distilled water, and a little white unwoven silk, consisting of ten threads a centimetre in length. If the quantity of magenta contained in the wine is at all notable acetic acid produces at once a rose colouration, but when only minute traces are present the ether is allowed entirely to evaporate. The residue consists of a small quantity of aqueous liquid, in which the silk soaks. The capsule is then very gently heated, so as to evaporate the bulk of this liquid, and concentrate the traces of colouring matter in a few drops, thus favouring its fixation upon the silk. This process, if carefully executed, reveals one hundred-millionth part of magenta in wine.

Reimann's Farber Zeitung. No. 39, 1876.

Pittakall is manufactured by a company in Hanover under the name of violacein.

The use of vanadic aniline-blacks is greatly on the increase in France. The colour obtained is fast, both as against milling and acids.

Mahogany is again recommended as a dye-ware. The shades obtained are reported to resemble the colour of the wood itself, and to be very fast. The mordants used are acetate of alumina for cotton, and sulphates of iron and copper for wool.

MISCELLANEOUS.

Organisation Among Chemists.—The adjourned meeting to discuss this subject assembled in the Chemical Society's Room, Burlington House, on Saturday, November 4th, 1876. Prof. F. A. Abel, F.R.S., President of the Chemical Society, in the Chair. The minutes of the previous meeting were read and confirmed. The

Report of the Committee appointed to confer with the Council of the Chemical Society was read. It was proposed by Mr. J. A. Wanklyn and seconded by Prof. Redwood:—"That the cordial thanks of the meeting be tendered to the President and Council of the Chemical Society for the consideration given by them to the proposals of the Organisation Committee, and for the efforts made by them to meet the views of the Committee in relation to these proposals." (Carried unanimously.) It was proposed by Prof. Frankland, F.R.S., seconded by Dr. Voelcker, F.R.S., and supported by Dr. Williamson, F.R.S.:—"That, having regard to the limited powers of the Chemical Society under its charter, it is desirable that an Association be formed that shall be independent of the Chemical Society, and that the Organisation Committee already formed be dissolved, and that the following gentlemen, or such of them as may be willing to act, form a new Committee (with liberty to add to their number) to settle the form and details of the scheme, and to take all steps necessary to secure the formation and incorporation of the proposed new Association." (Carried unanimously.) The proposed Committee are the following:—Prof. Abel; Mr. A. H. Allen (Sheffield); Dr. H. E. Armstrong; Prof. Attfield; Mr. James Bell; Mr. I. Lowthian Bell (Middlesbrough); Prof. Bloxam; Prof. Crum Brown (Edinburgh); Mr. M. Carteighe; Mr. Dugald Campbell; Mr. W. Crookes; Mr. G. E. Davis (Runcorn); Dr. Dupré; Prof. James Dewar (Cambridge); Mr. F. Field; Mr. R. J. Friswell; Prof. Frankland; Prof. Gladstone; Mr. George Gore (Birmingham); Prof. Galloway (Dublin); Mr. C. E. Groves; Mr. W. N. Hartley; Mr. C. W. Heaton; Mr. Douglas Hermann (St. Helens); Mr. David Howard; Mr. C. T. Kingzett; Prof. Marrèco (Newcastle); Mr. F. A. Manning; Dr. E. J. Mills; Dr. Hugo Müller; Mr. E. Neison; Prof. Odling (Oxford); Mr. F. J. M. Page; Mr. J. Pattinson (Newcastle); Dr. B. H. Paul; Mr. W. H. Perkin; Mr. C. H. Piesse; Prof. Redwood; Prof. Emerson Reynolds (Dublin); Dr. W. J. Russell; Dr. R. Angus Smith (Manchester); Dr. H. Sprengel; Dr. Stevenson; Mr. R. Tatlock (Glasgow); Mr. E. T. Teschemacher; Prof. R. V. Tuson; Dr. Voelcker; Mr. J. A. Wanklyn; Prof. Williamson; Mr. J. T. Way; Dr. C. R. A. Wright. A vote of thanks to the Chairman (Prof. Abel) for presiding was carried by acclamation, and a vote of thanks to the Secretaries terminated the proceedings. The majority of the gentlemen whose names have been proposed have agreed to aid in forming the Institution.

New Work by Professor Hayden.—An important work is now being issued by Prof. F. V. Hayden, whose name is a sufficient guarantee of its scientific value. The title is "The Yellowstone National Park and the Mountain Regions of Portions of Nevada, Idaho, Colorado, and Utah," by Prof. F. V. Hayden, Geologist-in-charge of the U.S. Government Expeditions to the Yellowstone Valley of the years 1871 and 1872, and of the U.S. Geological and Geographical Survey of the Territories. The work is illustrated by chromo-lithographic reproductions of water-colour sketches taken by Thomas Moran. The price for the complete work, 5 parts, with text, is 50 dollars. The text will be published simultaneously in English, French, and German. The list of plates includes Hot Springs of Gardiner's River, Yellowstone National Park; The Great Blue Spring of the Lower Geyser Basin, Yellowstone National Park; The Castle Geyser—Upper Geyser Basin, Yellowstone National Park; Lower Yellowstone Range, Yellowstone National Park; Yellowstone Lake, Yellowstone National Park; Tower Falls and Sulphur Mountain, Yellowstone National Park; Head of Yellowstone River, Yellowstone National Park; The Grand Canon, Yellowstone, Yellowstone National Park; The Towers of Lower Falls, Yellowstone National Park; The Mountain of the Holy Cross; The Mosquito Trail, Rocky Mountains of Colorado; Summit of the Sierra Nevada; Great Falls of Snake River; Valley of Babbling Waters, Southern Utah; The Great Salt Lake of Utah.

MEETINGS FOR THE WEEK.

MONDAY, 27th.—Royal Geographical, 8.30.
——— Medical, 8.
——— Society of Arts, 8. Cantor Lectures.
TUESDAY, 28th.—Civil Engineers, 8.
——— Anthropological Institute, 8.
——— Manchester Literary and Philosophical Society, 7.
WEDNESDAY, 29th.—Society of Arts, 8.
THURSDAY, 30th.—Royal, 4. (Anniversary.)
FRIDAY, Dec. 1st.—Geologist's Association, 8.
SATURDAY, Dec. 2nd.—Physical, 3. "On some Mechanical Illustrations of Thermo-Electric Phenomena," by O. J. Lodge, B.Sc.

TO CORRESPONDENTS.

J. J. L.—We should think the . is alum in the paste.

G. M.—The part of the Report to which you refer has not yet appeared in our columns.

K. L.—Dr. Versmann's letter renders the publication of your's unnecessary.

ERRATUM.—Page 212, col. 1, line 3 from top *for* "250° C." *read* "275° C."

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THE CHEMICAL NEWS.

VOL. XXXIV. No. 888.

ON REPULSION RESULTING FROM RADIATION.—PART II.*

By WILLIAM CROOKES, F.R.S., &c.

(Continued from p. 220).

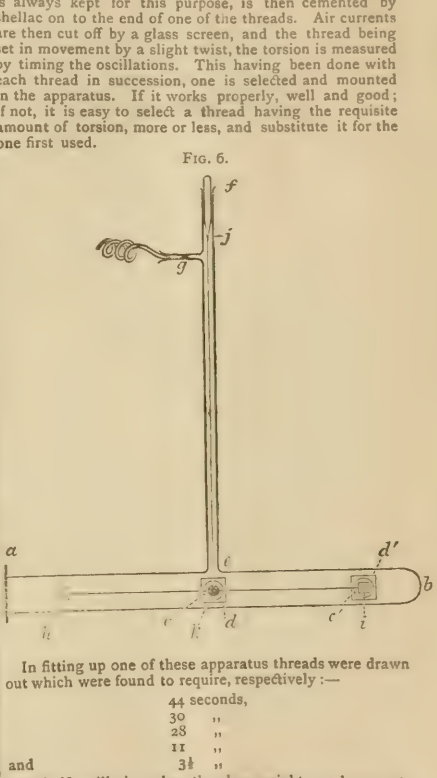
101. THE difficulty which attended experiments with the balances and bulb apparatus used at first was to bring the moving part accurately back to zero, and also to measure the deflection produced. I therefore tried several plans of giving a fixed zero-direction to the movable index. Thus a piece of magnetic oxide of iron was cemented to one end of the index, and a permanent magnet was brought near it. This answered pretty well, but was inconvenient, besides not being sufficiently accurate. A bifilar suspension from cocoon-fibres seemed likely to succeed better; but the difficulty of suspending the rod in this manner, so as to get exactly the same tension on each fibre, was very great, and unless this was done there was more tendency to move in one direction than in the other. When I had succeeded in suspending the needle with an equal tension on each silk fibre, I found their elasticity to vary; and as soon as the vacuum was approached one was sure to contract more than the other, twisting the needle out of the axis of the tube, and sometimes causing it to touch the side. This method of suspension was therefore abandoned.

By increasing the length of the needle, and also of the fibre used to suspend it, it was possible to employ fibres with a considerable amount of torsion, and still preserve the delicacy of the apparatus. Fine platinum wire was first tried; but this was soon abandoned in favour of glass fibres, which were found to answer so perfectly that I have since used nothing else.

102. Fig. 7 shows the form of apparatus which I have finally adopted, as combining the greatest delicacy with facility of obtaining accurate observations, and therefore of getting quantitative as well as qualitative results. It is a torsion apparatus in which the beam moves in a horizontal plane, and may be called a horizontal torsion balance. *a b* is a piece of thin glass tubing, sealed off at the end *b* and ground perfectly flat at the end *a*. In the centre a circular hole, *c*, is blown, and another one, *c'*, at the end; the edges of these holes are ground quite flat. *a*, *c*, and *c'* can therefore be sealed up by cementing flat transparent pieces of plate glass, quartz, or rock-salt, *a*, *d*, and *d'* on to them (83). To the centre of *a b* an upright tube, *e f*, is sealed, having an arm, *g*, blown on to it for the purpose of attaching the apparatus to the pump. *h i* is a glass index, drawn from circular or square (22) glass tube, and as light as possible consistent with the needful strength. A long piece of this tube is first drawn out before the blowpipe; and it is then calibrated with mercury until a piece is found having the same bore throughout: the necessary length is then cut from this portion. *j k* is a very fine glass fibre, cemented at *j* to a piece of glass rod, and terminating at *k* with a stirrup, cut from aluminium foil, in which the glass index, *h i*, rests. In front of the stirrup is a thin glass mirror, shown at *k*, silvered by Liebig's process, and either plane or concave as most convenient. At the ends of the glass index (*h i*) may be cemented any substance with which it is required to experiment; for general observations I prefer to have these extremities of pith, as thin as possible, and exposing a surface of 10 millimetres square. The pith may be coated with lampblack or silver, or may retain its natural surface.

103. The preparation of the suspending thread of glass requires some care. It should be drawn from flint glass, as this gives much tougher threads than foreign glass. The diameter varies with the amount of torsion required; it may be 0·001 inch or less. I select the piece best adapted for the special experiment in the following way:—Several threads of glass are first drawn out before the blowpipe, and a certain number selected as being likely to answer the purpose. These are then suspended side by side to a horizontal rod and equalised as to length. A piece of glass rod, about 2 inches long, which is always kept for this purpose, is then cemented by shellac on to the end of one of the threads. Air currents are then cut off by a glass screen, and the thread being set in movement by a slight twist, the torsion is measured by timing the oscillations. This having been done with each thread in succession, one is selected and mounted in the apparatus. If it works properly, well and good; if not, it is easy to select a thread having the requisite amount of torsion, more or less, and substitute it for the one first used.

FIG. 6.



In fitting up one of these apparatus threads were drawn out which were found to require, respectively:—

44 seconds,
30 ,,
28 ,,
11 ,,
and 3½ ,,

for a half oscillation when the glass weight was hung on to their ends. The one oscillating in 30 seconds was first used, but was found to give insufficient torsion. The one making half an oscillation in 11 seconds was then used, and was found to answer well. Before I adopted this plan days were frequently wasted in the attempt to hit upon a glass thread of the requisite degree of fineness.

104. In taking accurate observations with an apparatus of this description, it is necessary to support it on a stand firmly fastened to a main wall. When resting on a bench, or connected to any other way to the floor, there is a constant oscillation which keeps the index from zero.

The apparatus being fastened firmly to its stand, accurately levelled, and sealed on to the pump, a divided scale, *a b* (fig. 8), is placed four feet from the small mirror; and immediately beneath the scale is a narrow brass slit.

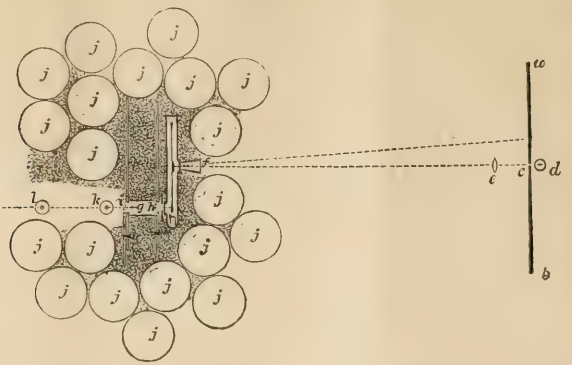
e, illuminated by a lamp, *d*. In front is a lens, *e*, which throws the image of the slit on to the mirror, where it is reflected back again on to the divided scale. Here the angular movement of the bright line of light shows the minutest attractive or repulsive force acting on the pith at the extremity of the movable index.

In order to keep the luminous index accurately at zero, except when experiments are being tried, extreme precautions must be taken to keep all extraneous radiation from acting on the apparatus. A slightly conical paper tube, *f*, about 6 inches long, and as narrow as the angular movement of the ray of light will admit of, is cemented on to the glass window in front of the mirror; and a similar tube, *g*, is cemented on to the quartz window in front of the pith surface on which radiation is to act. The latter tube is furnished with card shutters, *h*, *i*, at each end, capable of easy movement up and down. The whole apparatus is then closely packed on all sides with a layer of cotton-wool, about 6 inches thick, and outside this is arranged a double row of Winchester quart bottles, *j*, *j*, filled with water and covered with brown paper, spaces being only left in front of the paper tubes. *k* and *l* represent the positions of the candle 140 and 280 millims. distant from the pith. The whole arrangement has the appearance shown in fig. 8.

105. I will not discuss at present the phenomena presented when the apparatus is full of air, or when the vacuum is imperfect, but will proceed to the effects observed when the exhaustion has been pushed to the highest attainable degree. However much the results may vary when the vacuum is imperfect, or when the apparatus is full of air, I always find them agree amongst themselves when the residual gas is reduced to the minimum possible; and I have also ascertained that it is of no consequence what this residual gas is. Thus I have started with the apparatus filled with various vapours and gases, such as air, carbonic acid, water, iodine, hydrogen, or ammonia; and at the highest rarefaction I find no difference in the results which can be traced to the residual vapour, assuming any to be present. A hydrogen vacuum seems neither more nor less favourable to the phenomena than does a water or an iodine vacuum. If moisture be present to begin with, it is necessary to allow the vapour to be absorbed by the sulphuric acid of the pump, and to continue the exhaustion with repeated warming of the apparatus until the aqueous vapour is removed; then only do I get the best results. When pith surfaces are used at the extremities of the glass beam, they should be perfectly dry; and they are more sensitive if the apparatus has held a vacuum for some weeks, as the residual moisture in the pith will then have been absorbed by the sulphuric acid in the pump.

(To be continued.)

Fig. 8.



NEW PROCESS FOR TITRATING ASTRINGENT SUBSTANCES.

By M. FERDINAND JEAN.

When we pour drop by drop a solution of iodine into any decoction of an astringent matter, previously mixed with an alkaline carbonate, we remark that this solution is absorbed with a great energy. I have observed that the absorption of the iodine takes place, in these conditions, in the direct ratio of the quantity of astringent matter taken, and that 1 part by weight of tannic acid absorbs 4 parts of iodine before we can observe the presence of free iodine in the liquid. It is on this action of iodine on astringent matters that the process of titration is based which forms the subject of this note. The solution of iodine necessary for titrating tannin is obtained by dissolving in iodide of potassium 4 grms. of iodine, and adding to the solution distilled water in quantity sufficient to make a volume of 1000 c.c. To ascertain the value of the solution of iodine, we introduce into a beaker 10 c.c. of a solution of tannin at 0·1 grm. per cent; we mix it with 2 c.c. of an alkaline lye containing 25 per cent of crystallised carbonate of soda; then, by the aid of a graduated burette, we cause to fall into the alkaline liquid the solution of iodine until a drop of the mixture, taken with the glass stirrer and put on a leaf of starched paper, produces a light violet spot, which indicates the presence of free iodine and the end of the operation. The value thus obtained must be corrected, that is to say we must deduct from the number of cubic centimetres of the solution of iodine corresponding to 0·01 grm. of tannin, the volume of this solution, which it is necessary to employ as pure loss before obtaining a coloured reaction on starched paper. For this purpose we measure 10 c.c. of distilled water, which is mixed with 2 c.c. of the alkaline solution; then we pour drop by drop the solution of iodine until we obtain a spot on the starched paper. With a solution of iodine, containing 4 grms. iodine per litre, the correction is commonly from 0·1 c.c., but the greater or less purity of the carbonate of soda may perhaps affect this correction very slightly. For 0·01 grm. of tannic acid dissolved in 10 c.c. of water we must generally use 10·5 c.c. of the solution of iodine at 4 per thousand. Under the influence of iodine the alkaline solutions of tannin, even diluted, take a colouration so intense that it

would not be possible to seize distinctly the colouration of iodide of starch if we added starch paste to the tanniferous liquid. This is why I have recourse to a leaf of white filter paper, which I cover by friction with a slight layer of powdered starch. The spots made on this paper with half a drop of liquor containing traces of free iodine are immediately absorbed and show the characteristic violet colouration, even when the liquid is deeply coloured. When the value of the solution of iodine is established with respect to a known weight of pure tannic acid, this test liquor may be employed to titrate the various astringent matters, if we adopt, as the authors of the processes for the determination of tannin hitherto published have done, tannic acid as the type of the active principle of astringent matters. But, if we wish to make very exact researches, it is necessary for each variety of astringent matter to be studied to ascertain the value of the solution of iodine by means of the pure astringent principle; for example, catechuic acid for catechu-moritannic acid for fustic; for the solution of iodine acts, without doubt, like other reagents in different proportion upon divers tannic acids. The tannic acid which I employ to establish the value of the solution of iodine is obtained by keeping the tannin of Pelouze at 80° in the water-bath. At this temperature a portion of tannin, about 42 per cent, melts, agglomerates into a greyish spongy mass, which contains the impurities of the tannin with the resins; the pulverulent part constitutes pure tannin and 10·5 c.c. of the solution of iodine at 4 per thousand correspond to 0·01 grm. of this tannin, whilst only 9·3 of the solution of iodine are required to saturate 0·01 grm. of the gummy matter. The titration of tannin by means of the solution of iodine being very rapid and very exact, I determined to apply it to the assay of natural astringent matters. For this purpose I had to ascertain whether the matters which accompany the tannin in vegetable extracts are without action on the solution of iodine. For this purpose I exhausted with 100 c.c. of distilled water 1·515 grms. of oak bark, which, assayed according to Hœner's process, contained 6·5 per cent of matter fixable by hide, and I performed in 10 c.c. of this decoction, containing consequently 0·01 grm. of tannin matters, the titration with a solution of iodine of which 10·5 c.c. corresponded to 0·01 grm. of pure tannic acid. If the extractive matters which accompany the tannin had acted on the solution of iodine I should have had to employ more than 10·5 c.c. of this solution; but in three assays I obtained the coloured reaction on starched paper. After having poured 9·8 c.c. of the solutions of iodine, I found then 5·92 c.c. per cent of tannin instead of 6·5 c.c., the value found in using Hammer's process. The discrepancy of 0·58, which the two processes give, must be attributed to the colouring matters which have been fixed by the hide along with the tannin in the assay by Hammer's process. In a second experiment I treated the same decoction of oak bark with an excess of powdered hide, and having separated by filtration the hide charged with tannin, I obtained, with 10 c.c. of the filtered decoctions, the reaction upon the starched paper after having employed 1·7 c.c. of the solution of iodine; whilst before the action of the hide it would be necessary to employ 9·8 c.c. But these 1·7 c.c. of solution of iodine, corresponded to 1·02 per cent of gallic acid, the average quantity of this acid, which has been remarked in French barks. Finally a decoction of oak bark was precipitated by acetate of copper. The tannate and the gallate of copper were separated by filtration, the filtered liquid was neutralised by carbonate of soda, then filtered anew to separate carbonate of copper. 10 c.c. of the clear solution, after an addition of 2 c.c. of a lye of carbonate of soda, only required 0·1 c.c. of the solution of iodine to produce a coloured reaction upon starch. This result shows very clearly that the extractive matters do not act on the solution of iodine, since we have only employed of this solution the volume which would have been necessary if we had operated upon distilled water, and nevertheless the liquor separated from the gallate and the tannate of copper contained all the extractive matters, save a small quantity of brown acids which the acetate of copper had precipitated. Having shown that in the decoction of oak bark it is only tannic and gallic acids that absorb the solution of iodine, the process of titration that I propose may be employed with all safety for the assay of tanniferous matters. I have found that crystallised gallic acid decomposes the solution of iodine exactly in the same ratio as tannic acid. If then we wish to determine separately the gallic and tannic acid, we must determine at first the volume of the solution of iodine corresponding to the two acids jointly; then, after having separated the tannic acid by powdered hide, titrate the gallic acid remaining in solution. On deducting from the volume of the solution of iodine corresponding to the two acids that which belongs to gallic acid alone, we obtain the quantity of tannic acid.—*Bulletin de la Société Chimique de Paris.*

ESTIMATION OF POTASSIUM AS ACID TARTRATE.*

By P. CASAMAJOR.

In most cases which present themselves to the chemist, in which potassium is to be estimated, it is accompanied by sodium, and the course usually pursued is to estimate the potassium directly as platino-potassic chloride. The precipitate obtained has the advantage that its weight is very great when compared to the weight of potassium in combination. There are difficulties, however, connected with the process, and there are cases in which it is not applicable without elaborate preparation; but platinic chloride, although expensive, is an excellent reagent, and, in experienced hands, very good results are obtained by its use.

Indirect processes are also in use, one of which consists in combining potassium and sodium with either chlorine or sulphuric acid, and in estimating the total quantity of salts by one operation and the quantity of either chlorine or sulphuric acid by another operation. From these two quantities the potassium and sodium can be calculated. Very good results are also obtained by this process.

There is also a very curious indirect process due to Gay-Lussac, to which I call your attention because I believe that it is not generally known, and because it presents a singular example of the expedients to which chemists have resorted to estimate potassium in presence of sodium. This process, which was in use some years ago in French saltpetre works, and may still be in use, is based on the following facts:—When 50 grms. of pure chloride of potassium are dissolved in 200 c.c. of water, the temperature of the liquid falls 11·4° C. If we take 50 grms. of chloride of sodium the fall of temperature will be only 1·9° C. Gay-Lussac has directed that the glass vessel in which the solution takes place should weigh 185 grms.—a point of some importance, as the vessel must acquire the temperature of the liquid it contains. To test a mixture of potassium and sodium salts they are brought, in the first place, to the state of chlorides and dried, and 50 grms. of the mixture are taken and dissolved in 200 c.c. of water. A decrease of temperature is noted, and the proportions of potassium and sodium chlorides are obtained from a table in which these proportions are placed, opposite numbers indicating the decrease of temperature. If this table is not at hand, the quantity of potassium chloride in 100 parts of the mixture may be found by calling the percentage of chloride of potassium x, and the decrease of temperature, in degrees C., d. Then $100-x$ will be the percentage of sodium chloride, and we shall have—

* Read before the American Chemical Society, September 7, 1876.

$$100\,d = 11{\cdot}4\,x + 1{\cdot}9\,(100 - x)$$

$$100\,d = 11{\cdot}4\,x + 190 - 1{\cdot}9\,x$$

$$100\,d = 9{\cdot}5\,x + 190$$

whence— $$x = \frac{100\,d - 190}{9{\cdot}5}.$$

My purpose this evening is to describe a process for the estimation of potassium as acid tartrate,—a process which has the advantage of being direct, and which gives results much more rapidly than can be obtained by any other means, while for accuracy they compare favourably even with those obtained by platinic chloride.

The occasion which led me to estimate potassium as acid tartrate was a series of experiments on the process of Messrs. Duncan and Newlands for separating potassium from the low products of sugar-houses by the addition of sulphate of alumina, and the consequent production of potassium alum. To avoid an excess of sulphate of alumina, which would be a waste, it became necessary to ascertain the quantity of potassium in each batch of products. For this determination platinic chloride is not very well adapted, as the first requisite was celerity rather than accuracy. The use of platinic chloride requires, in the first place, a thorough destruction of the organic matter by heat. The ashes, obtained as sulphates, are treated, in the next place, by an excess of barytic chloride, which gives a solution containing the chlorides corresponding to the sulphates in the ashes, and an excess of barytic chloride. From this solution, properly reduced in volume, potassium may be precipitated by platinic chloride.

Instead of this series of preparatory operations, to be followed by those required by the nature of the double chloride, it occurred to me, at first, to treat a small quantity of the low saccharine product by an excess of sulphate of alumina, and, from the quantity of alum obtained, to calculate that of sulphate of alumina required for the quantity of low products to be treated on a large scale. This idea afterwards led to that of substituting tartaric acid for sulphate of alumina, and, on trying tartaric acid, the results were so uniform and satisfactory that I was induced to apply it to the determination of potassium in compounds of all kinds.

Cream of tartar presents, over every other compound of potassium, the incomparable advantage that, while its solubility is very feeble, the estimation of it, by a titrated alkaline solution, is an operation that only takes a few minutes. To determine the quantity of cream of tartar that we may have to analyse it can be placed in a beaker glass with a sufficiency of water, which it is advantageous to heat, to increase the solubility of the acid tartrate. A few drops of litmus solution will impart a red colour, which will persist as long as any cream of tartar remains in the solution. If now we add a solution of potassa, drop by drop, to the contents of the beaker glass, the acid tartrate will be converted to the basic, and, while the change is going on, the unconverted cream of tartar will continue to colour the litmus red. When the last particle of acid tartrate has been converted to the basic, an addition of the smallest particle of potassa solution will turn the litmus blue. We may now note that the quantity of potassa added to convert the acid tartrate into the basic is exactly the same as the quantity already in combination as acid tartrate. We may note, moreover, that the equivalent of cream of tartar is exactly four times greater than the equivalent of potassa, so that if we have added 1 grm. of potassa to turn the litmus blue, we must have had 4 grms. of acid tartrate, holding in combination 1 grm. of potassa. After every addition of potassa the contents of the beaker should be thoroughly stirred, to dissolve the portions of acid tartrate which are undissolved, but which gradually become soluble as potassa is added. Before the change to the basic condition is complete the crystals of bitartrate disappear, and the red solution becomes perfectly clear. This is an indication that the end is near.

That acid tartrate of potassium is so well adapted to being tested by a titrated alkaline solution is the quality which, combined with its feeble solubility, recommended it as the compound in which to obtain potassium for analysis. We must, however, increase its insolubility if accurate results are to be obtained, and this can be easily accomplished by means of alcohol.

The insolubility of cream of tartar in a mixture of alcohol and water is greater than in pure water. The following table given by Chancel shows the solubility of cream of tartar in water at several temperatures :—

Degs. C.	100 c.c. of Water dissolve Grms. of Cream of Tartar.
0	0·24
5	0·30
10	0·37
15	0·45
20	0·55
25	0·67
30	0·805
35	0·96
40	1·13

Having had occasion to use this table repeatedly, I have verified these numbers and found them correct.

Chancel has also given us another column, representing the number of grammes of cream of tartar which 100 c.c. of water, containing 10 per cent alcohol, will dissolve at the same temperature. These numbers are nearly 57 per cent of those corresponding to pure water.

To discover the minimum of alcohol which will render a mixture with water incapable of dissolving cream of tartar, a great many experiments were made, and it was found that the mixture containing 60 per cent of alcohol fulfils this condition. By bringing all the liquids containing acid tartrate of potassium to the condition of containing at least 60 per cent of alcohol in volume, I have been able to obtain the whole potassium in the shape of insoluble cream of tartar.

Alcohol of this strength is not, however, to be used from the first, as it may in some cases interfere with the solution of the compounds to be analysed, and sometimes our potassium may be precipitated in other forms than cream of tartar. It should only be used at the last stage, immediately before throwing the precipitate on a filter, so that the acid tartrate in solution may be thrown down. It should also be used to wash the precipitate on the filter, to free it from tartaric and acetic acid, as we shall see hereafter.

To enable me to explain the method of procedure in estimating potassium as acid tartrate, let me take the simplest case which can present itself, which is the analysis of a solution of pure potassa in water. Suppose we have a deci-normal solution of potassa, containing 47 m.grms. of potassa for every c.c. of solution. If we drop 10 c.c. in a beaker glass we may convert the whole of it into acid tartrate if we add a sufficient quantity of tartaric acid. As to what constitutes a sufficiency, we may note that there ought to be enough to precipitate all the potassium to be tested, the minimum being four times as much acid as there is potassium in the compound. We may, however, use a quantity of tartaric acid six times greater than the quantity of potassium to be precipitated. Beyond this, in the presence of alcohol, the precipitate is apt to contain an excess of acid. I am unable to say in what shape this excess of acid exists; but if we use a marked excess of tartaric acid, as much as ten or twelve times more than the potassium to be precipitated, the test by a titrated solution of potassium will give an excess of 2 or 3 per cent. If we have any means of getting approximately at the quantity of potassium in a substance to be tested, we should use six times as much tartaric acid as the supposed quantity of potassium. If, on making the test, we should find that we have gone too wide of the mark, the quantity obtained in a first test will allow us to determine, to a certainty, the quantity to be used in a

subsequent analysis. As every test takes less than an hour, both tests together will take up less time than a single analysis by any other process.

(To be continued).

REPORT ON THE DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 221.)

Chlorine, Bromine, Iodine, and Fluorine.

By Dr. E. MYLIUS, of Ludwigshafen.

As an interesting fact we may call to mind that at the Paris Exhibition in 1867 large quantities of the silico-fluorides of sodium and barium, of soda-ash, and caustic soda were displayed by Tessié du Motay as products obtained by the application of fluoride of silicon and hydrofluo-silicic acid on the large scale. The hydrofluo-silicic acid was obtained by smelting silicic acid, fluor-spar, and charcoal in a blast-furnace, and receiving in water the fluoride of silicon contained in the flue gases,† a process founded on the observations of Bredberg (1829) and Berthier (1835), and elaborated in its details by F. Bothe.‡

Recently Christy and Bobrownicki‖ have taken out a patent in England for obtaining ammonia from ammoniacal waters by means of hydrofluo-silicic acid. They precipitate the ammonia from such water by means of hydrofluo-silicic acid, and decompose the precipitate by means of quicklime without the application of heat. Whether this attempt to employ a siliceous compound in extensive chemical operations will meet with a better fate than its predecessors time alone must decide. It is the first mention of fluorine in chemical technological literature for the last five or six years.

The applications of fluorides seem in fact to be dominated by some hostile influence. Even the use of hydrofluoric acid for etching on glass, which appeared secure from rivalry, will probably experience considerable limitation in consequence of an American invention. B. C. Tilghmann§ uses for etching on glass and other brittle materials a jet of sand violently projected against the surface of the object by means of a current of air or of steam. (The details of this process are, of course, strictly mechanical.)

Against such a rival fluoric acid cannot possibly maintain its ground for etching, especially where large surfaces are concerned. It will be restricted to the production of fine delicate designs, such as the graduation of measuring instruments.

The Sulphur Industry of Sicily. Extracted from the Report of the Mining Engineer, LORENZO PARODI,¶ by Dr. ANGELO BARBAGLIA, Professor of Chemistry at the Instituto Tecnico of Rome.

Sulphur is a widely diffused element which occurs under the most various forms both in the free and the combined state. In a free condition it forms rich deposits, which may be divided into two classes; such as are found on the surface of the earth in the neighbourhood of extinct volcanoes (*solfatare*) forming earthy strata from 6 to 10 metres in thickness saturated with sulphur, and underground beds (*solfare*) in which the sulphur is so intimately intermingled with the sedimentary rock that it must be obtained by mining. The latter deposits are the more important and furnish nearly the whole of the sulphur of commerce.

Geology.—The most important sulphur deposits are those of Italy.* On the main land are the beds of the Romagna, which yield yearly 120,000 quintals of sulphur those of Latera in the province of Viterbo, and those of Scrofano. Beds of sulphur have also been recently found in the provinces of Volterra, Grosseto, and Avellino.

(To be continued.)

* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzehends."

† Details concerning attempts at the industrial utilisation of hydro-fluo-silicic acid will be found in the article on the compounds of silica.

‡ Bothe, *Wagner Jahresber.*, 1868, 265.

‖ *Ber. Chem. Gesell.*, 1873, 1322.

§ B. C. Tilghmann. The sand-blast for cutting hard bodies.

¶ Sull estrazione dello solfo in Sicilia e sugli usi industriali del medesimo. Relazione dell ingegnére Lorenzo Parodi al Ministro d'agricultura, industria e commercia. Firenze, 1873.

QUANTITATIVE ANALYSIS OF COAL AND PEAT.

By SERGIUS KERN, St. Petersburg.

SEVERAL analytical processes have been used by me for the estimation of carbon, hydrogen, ash, and sulphur in various coals, and most of them were found to be very accurate, but rather troublesome in execution. The following process was used with great success and may be strongly recommended for laboratories of iron works, &c. By this process the work is easily and quickly executed, giving at the same time very accurate results.

1. *Estimation of Hygroscopic Water.*

3 grms. of the substance in a finely divided state are dried in a porcelain crucible placed in a beaker with a small quantity of sand on the bottom of it. The beaker is covered with a watch-glass, and the whole is placed on a sand-bath and heated for about three hours to a temperature of 110°. The end of the operation is easily known by the dryness of the watch-glass. The substance when dried is weighed, and the percentage of loss is next calculated.

2. *Estimation of Carbon and Hydrogen.*

The best process was found to be Liebig's:—The ignition of 1 grm. of coal or peat with lead chromate ($PbCrO_4$) in a tube of hard glass, 0·25 metre long. The resulting carbonic acid, water, and sulphuric acid are passed through a potash apparatus containing caustic potash (1 part of KHO dissolved in 2 parts of H_2O), and two U-tubes, the first containing ignited calcium chloride, the second a solution of lead nitrate. The increase in weight of the potash apparatus and of the first U-tube will show the quantity of carbonic acid and water obtained. Knowing that carbonic acid contains 27·2 per cent of carbon, and water 11·1 per cent of hydrogen, the percentage of carbon and hydrogen may be easily calculated.

3. *Calculation of the Calorific Power.*

As one part of carbon in burning yields 8080 calorific units, and 1 part of hydrogen in burning 34,460 calorific units, the calorific power of the coal may be quickly found.

Example.—Coal from Donetz Mountains, near the village Grouchevka, South of Russia:—

	Per cent.
Carbon	58·0
Hydrogen	11·0
Sulphur	1·0
Ash	23·0
Hygroscopic water	6·0
	99·0

For calculating the amount of calorific units in this coal we proceed as following:—

For carbon we have	0·58 × 8080 = 4686
For hydrogen we have	0·11 × 34460 = 3790
Total calorific units in the analysed specimen	8476

* This statement must be received with grave doubts. It is probable that Iceland contains a very much larger quantity of sulphur than Italy.—*Ed. C.N.*

4. *Estimation of Ash.*

1 grm. of powdered coal is heated in a muffle in an open platinum dish till all the carbon is burnt off. The remainder is the ash which is weighed.

5. *Estimation of Sulphur.*

0·5 grm. of powdered coal is heated with a mixture of 15 c.c. of HCl and 5 c.c. of HNO_3 for about one hour, and next left for 12 to 15 hours on a sand-bath. The liquor is filtered on a strong double filter to prevent the coal-dust passing into the filtrate. The sulphur is precipitated from the filtrate by barium chloride. The solution is left quiet for half an hour and is next filtered; the precipitate of $BaSO_4$ is washed, dried, and then weighed. Supposing 0·5 grm. of coal to be used for the analysis, every 0·001 grm. of barium sulphate obtained is equal to 0·02 per cent of sulphur.

Obouchoff Steel Works,
St. Petersburg.

PROCEEDINGS OF SOCIETIES.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, October 3rd, 1876.

"*On the Action of Water and Saline Solutions upon Lead*," Part II., by M. M. PATTISON MUIR, F.R.S.E., Assistant Lecturer on Chemistry, Owens College.

(Concluded from page 225).

5. DOES free admission of air to the surface, or passage of air through the body of the liquid influence the quantity of lead dissolved? The bearing of the experiments upon this question will be best seen by tabulating the results so as to bring together the quantities of lead dissolved by the same liquid acting on a fixed surface, but under varying conditions of exposure to air.

This is done in Table II.

I have not tabulated the whole of the results here, but only those which are directly comparable with one another.

6. It is scarcely admissible from these experiments to conclude that exposure to air invariably causes an increase in the quantity of lead dissolved. As in the consideration of the influence of surface exposed, it was found to be difficult, if not impossible, to eliminate other circumstances which modified the action, so here we appear to have many conditions tending to overshadow the effects of that one which it was especially desired to study. If we compare the quantities of lead dissolved in corked flasks and in open beakers, the action appears to be greater in the former than in the latter cases, until we come to deal with actions allowed to proceed during considerable periods of time, and upon somewhat extended surfaces of lead. When the surface exposed extended to 50 sq. cm. (to 500 cbc. of liquid) and the time of action amounted to 300 to 500 hours, the exposure of the surface of liquid to a considerable surface of air invariably increased the quantity of lead dissolved in a given time.

In these experiments the surface of liquid exposed to the air was increased from about 2 to about 100 sq. cm.

By comparing the quantities of lead dissolved in flasks or beakers and in open basins we find that there is invariably a very marked increase in the latter cases. The increase here also becomes more marked when the action has been allowed to proceed for tolerably extended periods of time.

In these experiments the surface of liquid exposed to the action of air increased from about 2 to about 170 sq. cm.

A.—Liquid employed, Distilled Water.

Description of Vessel.	Surface of Lead.	Total Lead (in Mgms.) Dissolved after— Hours. 42	168	330	340	505
Corked flask	25	0·7	—	—	1·2	1·5
Beaker half filled with water 11·5 cm. diam. at mouth	,,	0·4	—	—	0·5	0·8
Basin, 14·5 cm. diam.	,,	0·6	—	—	2·0	4·2
Flask with air passed through	,,	—	—	—	1·5	2·0

B.—Liquid employed, Distilled Water.

Vessel.	Surface.	Lead Dissolved. Hours. 42	168	336	340	505
Flask	50	0·7	—	—	0·9	1·0
Beaker	,,	0·4	—	—	1·2	1·8
Basin	,,	0·8	—	—	1·5	3·5

C.—Liquid employed, Potassium Nitrate, 0·20 grm. per Litre.

Flask	25	0·7	—	—	1·2	1·6
Beaker	,,	0·4	—	—	0·4	0·5
Basin	,,	0·8	—	—	2·8	6·0

D.—Potassium Nitrate, 0·20 grm. per Litre.

Flask	50	1·0	—	—	1·2	1·5
Beaker	,,	0 6	—	—	2·2	2·5
Basin	,,	1 1	—	—	2·8	3·5

E.—Calcium Chloride, 0·20 grm. per Litre.

Flask	25	—	1·3	1·8	—	3·0
Beaker	,,	—	1·3	1·5	—	2·8
Basin	,,	—	2·0	3·0	—	5·5
Flask with air	,,	—	3·5	3·5	—	3·5
Beaker—lead partly suspended in liquid, partly in air	,,	—	1·4	2·5	—	3·5

F.—Calcium Chloride, 0·20 grm. per Litre.

Flask	50	—	2·0	2·5	—	2·5
Beaker	,,	-	2·0	3·0	—	3·5
Basin	,,	—	2·5	3·5	—	4·5
Flask with air	,,	—	0·5	0·5	—	? 0·5
Beaker—lead partly suspended in air	,,	—	2·1	3·5	—	4·0

G.—Potassium Carbonate, 0·20 grm. per Litre.

Flask	25	—	traces	0·3	—	0·3
Beaker	,,	—	0·2	0·3	—	0·3
Basin	,,	—	0 5	0·7	—	0·7
Flask with air	,,	—	0·4	0·6	—	0·6
Beaker—lead partly suspended in air	,,	—	traces	0·2	—	0·3

H.—Potassium Carbonate, 0·20 grm. per Litre.

Flask	50	—	traces	0·3	—	0·3
Beaker	,,	—	0·2	0·3	—	0·3
Basin	,,	—	0·7	0·9	—	0·9
Flask with air	,,	—	0·5	0·5	—	0·5
Beaker—lead partly in air	,,	—	0·5	0·7	—	0·7

I.—Ammonium Sulphate, 0·20 grm. per Litre.

Flask	25		0·5	0·7	—	0·7
Beaker	,,	—	0·7	1·0	—	1·3
Basin	,,	—	2·5	9·0	—	16·0 ?
Flask with air	,,	—	1·3	3·0	—	5·0
Beaker—lead partly in air	,,	—	0·8	1·5		2·5

J.—Ammonium Sulphate, 0·20 grm. per Litre.

Flask	50	—	0·7	0·7	-	0·7
Beaker	,,	—	0·7	1·0	—	1·5
Basin	,,	—	2·5	7·5	—	? 12·0
Flask with air	,,	—	0·7	1·3	—	2·5
Beaker—lead partly in air	,,	-	1·0	2·0	—	3·5

It may be that the relation between lead exposed and total quantity of liquid influences the action of the air upon the metal; this point I propose to examine in a further communication. The passage of air through the various liquids certainly caused an increase in the quantity of lead dissolved as compared with those quantities found when the action was allowed to proceed in closed flasks; nevertheless, in every case—with one exception—considerably smaller quantities were dissolved when air was passed through the liquids, than when large surfaces of liquid were merely exposed to the action of the superincumbent air.

I have already pointed out, when considering the influence of the extent of surface of lead exposed, that the only experiments in which a constant increase in lead dissolved (independent of the salt in solution, the time, &c.) was noticed, were those in which the lead was partially suspended in the liquids and partially surrounded by air, the liquids being contained in beakers and exposing a surface of about 100 sq. cm. to the surrounding air. If we compare the quantities of lead dissolved under these conditions with the quantities dissolved in experiments carried out in a precisely similar manner, except that the lead was wholly surrounded by liquid, we find that there was a small but constant increase in the former cases; the quantities dissolved in these cases were not so large as those which passed into solution when the experiments were carried out in basins and the lead was wholly immersed in the liquid. On the whole, then, the exposure of the various liquids to a large surface of air appears to cause an increase in the quantity of lead dissolved; this increase becomes specially marked after the lapse of considerable periods of time.

7. Do the solvent actions of dilute saline solutions upon lead continue during lengthened periods of time, or is there a limit reached after which little or no further action is exercised upon the lead?

By consulting the two tables it becomes very evident that so far as these experiments allow one to judge there is a constant increase of lead dissolved with increase of time of action, except in the case of those solutions which contain carbonate of potassium. This increase appears to be proportionately greater in the case of those salts (nitrates, &c.) which aid the solvent action, than of those which tend to stop the solvent action of water upon lead. This increase is also greater for equal time-intervals, when a large surface of liquid is exposed to the surrounding air than when a small surface is so exposed. The increase was not very marked when the experiments were conducted in flasks, through which a stream of air was constantly passed.

The exception which I have made in favour of potassium carbonate, when laying down the general rule, that increase of duration of action increases the quantity of lead dissolved, requires explanation. On examining the actual numbers obtained it is evident that the amount of lead dissolved by liquids which contained potassium carbonate did increase as the action proceeded, up to a certain point; this increase was, however, very slight, and after the expiry of 340 hours it ceased. Hence, I conclude provisionally that in the presence of this salt the solvent action of water upon lead soon—comparatively speaking—reaches a maximum. I intend to investigate this subject more fully in a future communication.

8. In conclusion, it appears to be shown by these experiments that the solvent action of dilute saline solution upon lead tends to attain a maximum when large surfaces of liquid are exposed to the surrounding air, and when the volume of liquid is large in proportion to the surface of lead exposed. Further, that under these conditions, and in the presence of those salts which aid the action—especially nitrates, and more especially ammonium nitrate—the quantity of lead dissolved increases in an increasing ratio with the time during which the action is allowed to proceed.

Many experiments must, however, be yet carried out before I can permit myself to generalise with safety, and these experiments must be conducted on a larger scale before the results obtained can be applied to the actual conditions which influence the mutual action of water and lead in our domestic water supply.

9. By comparing the absolute quantities of lead dissolved as stated in the foregoing tables with those tabulated in the former papers and obtained under somewhat comparable circumstances, it is apparent that the present numbers are much smaller than the former. This I believe to be due to the chemical purity of the lead itself. In former experiments I made use of ordinary sheet lead; in the present experiments what is sold by the chemical dealer as "pure lead" was employed. I believe that many contradictory results noticed in the numbers obtained by different experimenters on the subject of the action of water on lead can be traced to slight differences in the purity of the lead employed by them. I purpose to examine this subject quantitatively, and hope, on a future occasion, to lay the results before the Society.

NOTICES OF BOOKS.

Report on the Ventilation of the Hall of Representatives and of the South Wing of the Capitol of the United States. By R. BRIGGS, C.E. Philadelphia: H. B. Ashmead.

WHAT can be simpler, theoretically speaking, than ventilation? Air as it is contaminated by the products of combustion and of respiration, and by the effluvia from the bodies of animals, is heated *pari passu*. Now, as gaseous matter under such circumstances expands and becomes specifically lighter, the foul air has a tendency to ascend, and all we have to do is to make two apertures, one at the top and the other at the bottom of the building, when, heigh! presto! the foul air will escape from the former, whilst fresh pure air will rush in from below and take its place. Yet this system, so admirable in its broad theoretical outline, in practice will not work at all. The aperture in the roof of the building made for the ascent of the impure air becomes the battle ground of contending currents. Sometimes the rising stream flows out unchecked and then again the cold external air forces its way down upon the heads of the inmates. Nor is it actually true that foul air is always and necessarily heated. The "ground gases," which Prof. v. Pettenkoffer has brought to our knowledge, are no less dangerous than the effluvia from living animals, but their temperature is low and they ooze into houses and public buildings from beneath. Hence, wherever a large number of persons are likely to be collected together, as in churches, theatres, courts of justice, legislative halls, &c., special arrangements are required for the construction and adaptation of which sound physical knowledge is required. Even when eminent authorities have been consulted and expense has been incurred without limit the result is frequently far from satisfactory. Some of us may yet remember the verses in *Punch* beginning:—"This is the house that Barry built."

According to the view taken in the pamphlet before us the allowance of air per minute for each individual in a public building may range from 30 cubic feet in winter to 100 cubic feet in summer. This supply in a hall like that of the American House of Representatives, which may at times contain 1600 persons, will therefore range from 50,000 to 100,000 cubic feet per minute. In many instances there is some difficulty in selecting a suitable place whence so large a volume of air may be safely drawn. If the opening be near the surface of the soil "ground air," sewer gases, emanations from "made ground," and from putrescent matter of all sorts and dust may be sucked in. Nor is the summit of a tower any

great improvement. The authors of the report before us remark:—"The elevated air is more impure when the stratum of diffused chimney exhalations is reached, than it is below. The Londoner *does not* experience any great sense of purity of air from the top of St. Paul's as a general rule; and the haze of any large city is perceptible for miles on a still day—the entire city is covered as with a blanket by an *ascending* and *dispersing* cloud, and receiving its fresh air from beneath from all sides." In the American Capitol the air is drawn from the level of an elevated terrace, some 30 feet wide and 35 feet in height, beyond which lies a park, 800 to 1000 feet in width, carefully drained, and, as a matter of course, free from nuisances. A more favourable locality for drawing a supply of pure air could not well be selected. But when a proper source of fresh air has been found its introduction into the room involves two questions which may lead to four different systems. Are we to adopt the "*vacuum*" or the "*plenum*" method? In other words, are we to draw the foul air out or to force the fresh air in? A little consideration will show that the latter or *plenum* method is decidedly preferable. If we suck out the foul air, other air will stream in to supply its place, not merely from our carefully selected source of a supply, but from every conceivable quarter. We shall suck in "ground gases" from the soil beneath and through the foundations. The next question is whether we are to introduce pure air from above or from below? If we select the former method our descending stream of pure air meets the stream of contaminated air arising from the persons of the occupants, and the latter current, instead of being withdrawn as quickly and quietly as possible, is beaten back upon the inmates, and runs a great risk of being inhaled over again. The method actually adopted in the Hall of Representatives is the plenum from below. As a matter of course the temperature of the in-flowing current requires to be regulated. By means of a system of steam-pipes it is kept at the uniform heat of 70° F., which is found most conducive to the comfort of those present in the building. The fresh air enters through vertical gratings in the steps of the platforms, upon which the seats of the members are placed. The reason why horizontal gratings in the floor were not adopted is somewhat singular.

"The nearest approach to a uniform distribution would of course have been attained by the perforated floor and porous carpet of the House of Lords, England, but the habits of our people in use of tobacco put this method out of the question."

We learn from the Appendices that the arrangements or the ventilation of the Hall of Representatives, though originally well designed and efficient, have not been in all points maintained in thorough working order. The best systems in ventilation, as in everything else, are of little avail unless they are carefully attended to. The authors conclude with a significant reflection:—"The truth is, all our heating and ventilating appliances are a compromise of conditions—a truth extending beyond all mechanical operations to the phenomena of nature herself." On this we may all meditate with advantage.

Programme of the Royal Rhenish-Westphalian Polytechnic School of Aachen, for the Course 1876-77.* Aachen: J. J. Beaufort.

On a former occasion we have called attention to the admirable arrangements of this college for the study of applied science, and we find that they are still maintained in full efficiency. As an instance of the combined thoroughness and many-sidedness evinced in the culture of science, we may briefly describe the chemical course:—Dr. Landolt gives six lectures weekly on experimental chemistry, the winter term being devoted to the inorganic and the summer term to the organic department. There is a "chemical colloquium" of one hour weekly, for the purpose of impressing the more important points of pure chemistry upon the students. Dr. Classen gives instructions in analytical chemistry two hours weekly, and the analytical department of the laboratory is open daily, except Saturday, for seven hours, under the superintendence of Prof. Landolt, and Drs. Classen, Brühl, and Clören. Prof. Stahlschmidt gives weekly four hours' instruction in technological chemistry, and four hours in the construction and arrangement of chemical manufactories, and, with his assistants Drs. Böckmann and Scheele, superintends practical work in the technological laboratory daily, except Saturday. Dr. Brühl lectures twice weekly in the summer term on theoretical chemistry. Dr. Landolt gives practical instructions in saccharimetry. Dr. Classen gives, in the summer time, one lecture weekly, on chemical jurisprudence and toxicology, and in the winter term on the determination of the illuminating power of gas and its technological analysis. Prof. Stahlschmidt lectures weekly on brewing and on the manufacture of beet-root sugar. Dr. Böckmann delivers two lectures weekly on dyeing and calico-printing, and two on stœchiometry. In addition to all these facilities the students have the opportunity of visiting different chemical works in the surrounding country. We commend these complete and thoroughgoing arrangements to the careful consideration of the authorities of our new colleges in Leeds, Newcastle, Birmingham, and Bristol.

* "Programm der Königlichen rheinisch-westfälischen Polytechnischen Schule.

CORRESPONDENCE.

ANTHRACENE PRODUCTION.

To the Editor of the Chemical News.

Sir,—In your journal of the 17th inst. is published an article on "Anthracene Production," by Dr. Frederick Versmann, in which the balance-sheet of the Chemische Industrie Actien Gesellschaft of Elberfeld, as recently published, is referred to in the following manner:—

"In Germany all public companies are very properly compelled by law to publish their annual balance-sheet in at least three newspapers, and such document—published only on the 10th inst., in the *Cologne Gazette*—by the 'Chemische Industrie Actien Gesellschaft zu Elberfeld,' formerly Gessert Brothers, tells its own tale in a few figures. This official document informs the shareholders that the loss of the twelve months' working, ending at Midsummer last, amounts to £40,000; and as this dismal statement is merely a repetition of previous equally unsatisfactory balance-sheets, there seems to be little doubt that at next month's general meeting the Company will be wound up, and that very likely the whole capital—amounting to some £180,000—will be lost."

By request of the Chemische Industrie Actien Gesell schaft of Elberfeld we now beg to hand you a true copy of the said balance-sheet, from which you will see that the figures given by Dr. Versmann are inaccurate and his observations most unjustifiable.

The profit and loss account is debtor about £40,000, but this amount is the actual loss during the past three years, and not during one year. The capital of the company is £150,000, not £180,000.

Dr. Versmann takes upon himself to say that at the next general meeting of the company "very likely the whole of the capital will be lost."

As Dr. Versmann bases his remarks upon the figures given in the balance-sheet, we refer you to that document, which describes the position of the company on June 30, 1876, as under:—

Works, Plant, and other assets ..	2,890,680	44 marks.
Liabilities	689,989	28 ,,
Balance	2,200,691	16 ,,

or about £110,000.—We are, &c ,

POKORNY, FIELDER, and Co.

15, Fish Street Hill, London,
November 29, 1876.

[The name and address of Dr. Versmann was affixed to the article in question, and bearing in mind that he is an authority on the subject of anthracene, and indeed on any branch of the art and science of dyeing; that he is, moreover, a German, and was therefore in a position to satisfy himself that the sources from which he obtained his information were trustworthy, we did not hesitate to publish his paper. On receiving the above letter we communicated with Dr. Versmann, and we insert his reply. We have examined the copy of the balance-sheet, but we do not find it stated that the £40,000 is the loss during the past *three* years. We gladly, however, give publicity to the fact as stated by Messrs. Pokorny, Fielder, and Co. —*Ed.* C. N.]

To the Editor of the Chemical News.

SIR,—I am obliged to you for communicating to me Messrs. Pokorny, Fielder, and Co.'s letter to you before its publication, and thereby affording me the opportunity of at once replying to it.

These gentlemen, on behalf of the "Chemische Industrie Actien Gesellschaft," at Elberfeld, call my figures in reference to this Company inaccurate, and my observations unjustifiable. They point out two errors in the figures in my article, and to these I will confine myself.

I stated the loss of the last twelve months' working at £40,000. This information I took from the balance-sheet published by the Company in the *Cologne Gazette* of the 10th inst., which document is identical with the true copy sent to you by Messrs. Pokorny, Fielder, and Co. We are now told that £40,000 loss has been incurred during three years; but I submit the balance-sheet itself allows of but one reading. It is headed, translated, "Balance-sheet, June 30th, 1876, for the period from July 1st, 1875, to June 30th, 1876," and one of the items of this twelve months' working is put down as £40,000 loss. I really cannot be held responsible for any incorrectness in the official published balance-sheet.

The second point refers to the amount of capital, which I stated at some £180,000, taking the share capital of £150,000 and debts of £30,000 together in one sum; and if the adding up of these two items, instead of specifying them, should have given any cause for complaint, I truly regret my short way of expression.

As to my observations generally, I need scarcely assure you that I have not been influenced by any unfriendly or personal feeling, as I am ignorant of the very names of any proprietors. But I shall be delighted to learn that I have drawn too gloomy a picture of the prospects of the company under the impression that the £40,000 had been lost during one year. However, as I am now informed that this adverse result has to be spread over three years, I most sincerely trust that this company will not only soon recover the heavy losses hitherto made, but will in no distant time become a concern very profitable to the shareholders.—I am, &c.,

FREDERICK VERSMANN.

35, Whitecross Place, Wilson Street, Finsbury, E.C.

ON ANTHRACENE PRODUCTION.

To the Editor of the Chemical News.

SIR'—Our attention has been drawn to the remarks of Dr. Frederick Versmann (CHEMICAL NEWS, vol. xxxiv. p. 211), who says "that most of the anthracene at present in the market is of a very doubtful character." From the complaints of our alizarine friends (as brokers in this article) we think the Doctor is quite justified in his scientific conclusions; we, of course, can only speak from a business point of view. We find that the best way to get over the difficulty is for the consumers to try a ton or so of each producer's make, by which means they become acquainted with the kind of anthracene that suits their working into alizarine. Both parties obtain mutual benefit. The alizarine manufacturer can calculate with certainty, and so avoid heavy losses; the producers, also, can obtain better prices by giving satisfaction. Apologising for troubling you,—We are, &c.,

JOSEPH BENNETT BROS.

22 and 23, Great Tower Street, London, E.C.,
November 27, 1876.

DISTILLATION OF SEAWEED.

To the Editor of the Chemical News.

SIR,—In Dr. Hofmann's report on iodine (see CHEMICAL NEWS, vol. xxxiv., p. 215) he speaks of my process having "evidently failed in practice," and that "nothing further has been heard of the distillation of seaweed, and the production of iodine from the residual charcoal." I beg to state that ever since 1863 the process has been worked with great success in the Island of Tyree and other parts of the West Highlands. The produce of iodine in that island has been increased nearly ten-fold, and I need only refer to the evidence of His Grace the Duke of Argyll before the Privy Council last year to show the remarkable benefit to the people of that island. It has not been largely extended, because all proprietors of shores are not so enlightened as His Grace.

Dr. Hofmann quotes a letter from me, written some time ago (p. 197), in which the price of iodine is quoted at 1s. 3d. per ounce; it is now only 2¾d. per ounce. In a short paper read before the British Association at their meeting here there are some interesting statistics about iodine, which I shall shortly send you for publication. Meantime, if Dr. Hofmann disbelieves in the existence of seaweed charcoal, I shall be glad to supply him with a thousand tons at a very low rate, and if he can make the order ten times as large it will afford me a proportional pleasure to execute it.—I am, &c.,

E. C. C. STANFORD.

The North British Chemical Company (Limited),
149, Hope Street, Glasgow, Nov. 26, 1876.

THE D-LINES SPECTRA FLAME EXAMINED BY THE BLOWPIPE.

To the Editor of the Chemical News.

SIR,—I feel so much indebted to your correspondent "NaHO" for calling attention to this important subject in the CHEMICAL NEWS, vol. xxxiv., p. 226, that I will waive the obvious advantage he takes by entering upon such a controversy under the shelter of an anonymous signature, and shall only remark, with reference to the personalities in his letter, that his opinion regarding my writings generally can only be of value in the eyes of the public when his real name, honestly and courageously appended to them, shows how much we may attach to it. If we are to judge of this value from the contents of the anonymous letter, our estimate will not be oppressively great.

Let us now weigh the facts adduced by your correspondent, and see if they can stand against my tentative "series, which," he rather ungrammatically observes, "*are* a fair specimen of the experimental method *as* followed by chemists."

(1.) He tells us that "at a white heat the sodium sal adherent to platinum wire is volatilised, while at a lowe

temperature the spectrum is more permanent." Now, considering that, in the experiment to which this remark refers, *the same platinum wire was used*, though inserted in different parts of the blowpipe "flame," the assertion here made by your correspondent is that the trace of sodium, having been first volatilised, is *reproduced* permanently by the use of a lower temperature!

(2.) The argument as to the production of the "D-lines" by the combustion of sodium in a vacuum tube, has been previously well considered by me. No one knows better than the distinguished editor of the CHEMICAL NEWS, who has succeeded more nearly than, perhaps, any man in Europe in the attempt to obtain it, that the artificial production of a *perfect* vacuum is almost, if not quite, an impossibility, and, where there is a particle of air, sodium will, in combustion, derive water. Has your correspondent tried the experiment himself? If not, let him do so, and he will find that soda is produced by the combustion, in spite of his "vacuum."

(3.) The opalescence caused in pure boric acid by the impingement upon it of the orange flame emitted from platinum *is* "positive evidence of the absence of sodium in (from?) that flame" when taken in conjunction with the other fact mentioned by me, that the orange flame from a sodium salt *removes that opalescence*.

(4). The *onus probandi* of showing that the "D-lines" are produced by sodium only evidently rests with the sodiumite. The supporter of the water hypothesis has only to show (as I consider I have fairly shown) that they are not.—I am, &c.,

W. A. Ross.

London, November 27, 1876.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances, de l'Academie des Sciences. No. 20, November 13, 1876.

Mineralogical and Geological Researches on the Lavas of the Dykes of Thèra.—M. Foqué.—The present paper is a report by MM. Chasles, Sainte-Claire Deville, Des Cloiseaux, and Daubrée. It appears that in all the lavas of Thera there are at least two, and often three, triclinar felspars. The predominant felspar (among the microlithes) is albite, but among the larger crystals it is sometimes labradorite, and sometimes anorthite. The labradoric lavas free from olivine and rich in tridymite contain a ferruginous pyroxene, and have a proportion of silica intermediate between those of the acid and the basic lavas. The anorthitic lavas in which olivine is abundant and tridymite rare contain very little silica, and may be regarded as basic rocks.

Influence of Temperature upon Magnetisation.—M. J. M. Gaugain.—In operating upon a bar of steel capable of undergoing a considerable transient variation the magnetism is much weaker at 300° than at the ordinary temperature. When, on the contrary, the transient variation of the bar is very small, the magnetisation is more powerful at 300° than at a lower temperature.

Hydrates of Copper Sulphate.—M. L. Magnier de la Source.—Copper sulphate presents several distinct degrees of affinity for water corresponding to the hydrates—

$CuSO_4,H_2O$ (constitutional water).
$CuSO_4H_2O + H_2O$.
$CuSO_4H_2O + 4H_2O$.
$CuSO_4H_2O + 5H_2O$.
$CuSO_4H_2O + 6H_2O$.

o complete this series must be added the hydrate, $CuSO_4,H_2O + 2H_2O$, which is formed when crystals of blue vitriol are exposed to dry air at 25° to 30°. This new hydrate is stable enough to resist a dry vacuum, whilst under the same circumstances the original hydrate loses its 4 molecules of crystalline water.

Margaric Chloride and its Derivatives.—A. Villiers.—This compound, $C_{32}H_{34}ClO_2$, was obtained by the action of phosphoric perchloride upon the margarate of soda.

Researches on Quercite.—L. Prunier.—The author considers that quercite is a compound forming the transition between the fatty and the aromatic series.

On Angelic Acid.—E. Demarcay.—Not suitable for abstraction.

Existence of Asparagin in Sweet Almonds.—L. Portes.—Having established the presence of asparagin, the author thinks it evident that in almonds—on account of their oily nature—the products of transformation due to the germinative process appear at an earlier period than in other seeds.

A Meteoric Iron, very rich in Nickel, found in the Province of Santa Catarina (Brazil).—E. Guignet and G. Ozorio de Almeida.—The specimen contains 36 per cent of nickel, and is free from chrome, cobalt, manganese, and copper; neither is it mixed with any earthy gangue.

Chemical Composition of the Water of the Bay of Rio de Janeiro.—E. Guignet and A. Teller.—Silica and alumina are constantly found in considerable amount, even in samples carefully filtered. The water has a decided alkaline reaction, due neither to ammonia nor to carbonate of ammonia, but to soda and potassa, present as silicates and aluminates.

Bulletin de la Société d'Encouragement pour l'Industrie Nationale. No. 34, October, 1876.

Methods employed to Determine the Nature of the Colouring Matters Introduced into Wines.—A report by MM. Balard, Pasteur, and Wurtz.—To detect indigo, which is often used in the shape of sulphate, the authors add a little sulphate of potassa, and precipitate with chloride of barium. The sulphate of baryta, after filtration and washing, appears white if the wine is free from indigo, but if that dye is present it has a decided blue tint. Magenta is probably never employed alone in the fraudulent coloration of wines, but along with indigo it can be made to produce vinous reds. To detect this dangerous impurity the authors agitate the suspected wine with a small quantity of amylic alcohol. This withdraws the dye, and collects upon the surface of the wine, where it forms a bright red stratum. If this rose-coloured liquor is treated with a small piece of clean white silk, not mordanted, the latter takes the well known shade of magenta, which turns yellow if the silk is touched with a drop of hydrochloric acid. An appendix by Dr. Stierlin gives a tabular view of the behaviour of different reagents with wines coloured with dyes as compared with pure red wine.

MISCELLANEOUS.

Organisation among Chemists.—The committee appointed to take this matter in hand met for the first time on Saturday, November 25, at Burlington House. There were twenty-eight members present. The following gentlemen were elected Officers of the Committee:—Dr. Frankland, Chairman; Dr. Williamson, Prof. Abel, and Dr. Voelcker, Vice-Chairmen; Dr. C. R. A. Wright, Treasurer; Mr. W. N. Hartley, Secretary. The names of Prof. Dittmar, of Glasgow, and of Dr. Graham, of University College, London, were added to the Committee, but it was decided that for the present no further additions should be made. A sub-committee of seven Members was appointed to prepare a draft scheme for the consideration of the General Committee upon which the constitution and

rules of the new association may be founded. The following were nominated by ballot to serve on this committee:—Prof. Abel, Mr. Carteighe, Prof. Frankland, Mr. W. N. Hartley, Mr. Neison, Dr. Voelcker, Dr. C. R. A. Wright.

The Royal Society.—Yesterday being St. Andrew's Day, the Anniversary Meeting of the Royal Society was held. The following Officers were elected for the ensuing year:—

President—Joseph Dalton Hooker, C.B., M.D., D.C.L., LL.D.

Treasurer—William Spottiswoode, M.A., LL.D.

Secretaries—Prof. George Gabriel Stokes, M.A., D.C.L., LL.D.; Prof. Thomas Henry Huxley, LL.D.

Foreign Secretary—Prof. Alexander William Williamson, Ph.D.

Other Members of the Council—Major-General John T. Boileau; Warren De la Rue, D.C.L.; Prof. P. Martin Duncan, M.B., P.G.S.; Prof. William H. Flower, F.R.C.S.; Prof. Michael Foster, M.D.; Edward Frankland, D.C.L.; Francis Galton, M.A.; William Augustus Guy, M.B.; John Russel Hind, F.R.A.S.; The Rev. Robert Main, M.A.; William Pole, C.E., Mus. Doc.; The Rev. Bartholomew Price, M.A.; Rear-Admiral G. H. Richards, C.B.; Henry Clifton Sorby, Pres. Mic. Soc.; Prof. Henry J. Stephen Smith, M.A.; Prof. Balfour Stewart, M.A.

MEETINGS FOR THE WEEK.

MONDAY, 4th.—Society of Arts, 8. (Cantor Lectures.) "The History of the Art of Coach Building," by Mr. G. A. Thrupp. Lecture III.—Carriages from 1770 to the present time.
—— Medical, 8.
—— Royal Institution, 2 (General Monthly Meeting).
—— London Institution, 5.
TUESDAY, 5th.—Civil Engineers, 8.
—— Zoological, 8.30.
WEDNESDAY, 6th.—Society of Arts, 8. "Street Tramways," by Captain Douglas Galton, R.E., C.B., F.R.S.
—— Geological, 8.
—— Microscopical, 8.
—— Pharmaceutical, 8.
THURSDAY, 7th.—Royal, 8.30.
—— Chemical, 8. "Analysis of a Species of Erythrophyll," by Prof. Church. "On Phenylendiamin," by Dr. Witt. "On Calcium Sulphate," by Mr. Hannay.
—— Royal Society Club, 6.30.
FRIDAY, 8th.—Astronomical, 8.
—— Quekett Club, 8.

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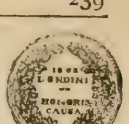

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THE CHEMICAL NEWS.

VOL. XXXIV. No. 889.

ON REPULSION RESULTING FROM RADIATION.—PART II.*

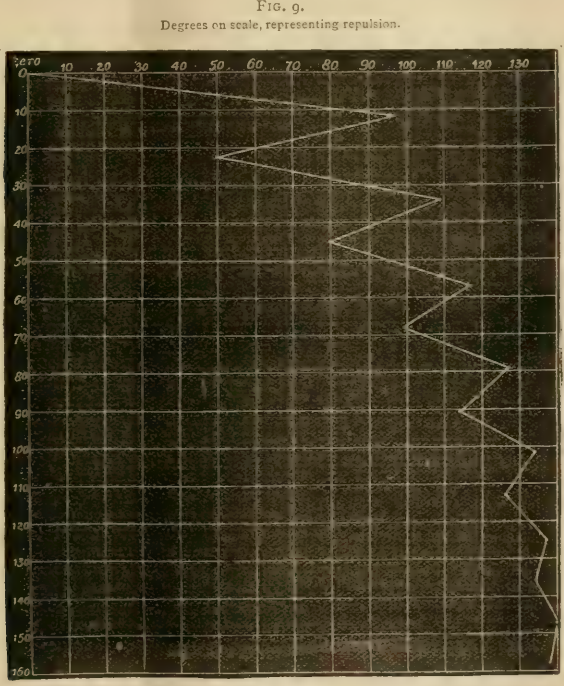
By WILLIAM CROOKES, F.R.S., &c.

(Continued from p. 230).

106. IT was found that when a source of light and heat is suddenly allowed to shine on the pith surface and not removed, a deflection rapidly takes place, attaining its maximum in about 11 seconds; the spot of light now returns a few degrees, and then proceeds in the first direction to a greater extent than at first. So it goes on, by alternate steps, advancing a little each oscillation, zero, where the spot of light normally rests. The vertical figures represent the seconds during which the experiment lasted. The zigzag line represents the oscillations of the spot of light, and shows the movement of the pith surface under the influence of a uniform source of radiation. The time was recorded by a chronograph. Starting from zero the spot of light is seen to have travelled to 97° in 11·5 seconds; at the end of 11 more seconds, or 22·5 seconds altogether, it had come back to 50°; at the end of 34 seconds the light had advanced again to 109°, and so on. The movements are tolerably uniform as to time, taking about 11·5 seconds for the half oscillation, but the amplitude of vibration is continually diminishing

107. If, however, the light is only allowed to shine on the pith surface for 11·5 seconds (or for as long as the spot of light takes to perform its first half oscillation), and if it is then instantly cut off, the spot of light almost invariably returns to zero and stops there, instead of swinging to the opposite side and only returning to rest after ten or a dozen oscillations, as is the case when the beam is set vibrating by mechanical means. This behaviour

FIG. 9.



until, if the light be feeble, the index takes up a nearly fixed position; if, however, the light be strong, the beam is driven against the side of the tube. In illustration of this I select the following series of observations from a large number recorded in my note-book. The horizontal figures represent the degrees on the scale, starting from

* A Paper communicated to the Royal Society, March 20, 1875. From the *Philosophical Transactions of the Royal Society of London*, vol clxv., pt. 2.

points to the return movement taking place under the influence of a force which remains active after the original radiation is cut off, and which is only gradually dissipated. This force is most probably from the heat which the pith has absorbed raising its temperature; and the steady return to zero seems to be due to the movement being controlled by the radiation of heat by the pith.

108. A series of observations taken with another apparatus, with the object of ascertaining the times o

Interposed Screen.	Magnesium wire burnt for 7·5 secs. distant 140 millims.	Standard candle, distant 140 millims.	Standard candle, distant 280 millims.	Copper ball 400° C., distant 140 millims.	Copper ball 400° C., distant 280 millims.	Copper ball 100° C., distant 140 millims.
	°	°	°	°	°	°
None	—	—	54	—	180	9
Rock-salt, 20 millims. thick, not very clear	—	148	52	220	—	6
Rock-crystal, in two pieces, 42 millims. thick altogether	—	88	32	115	—	1·5
Talc, clear but very dark, 1·25 millims. thick	—	100	28	90	—	2
Plate glass, white, 2 millims. thick, one piece	—	—	—	—	—	3·25
Ditto, two pieces	—	—	—	110	—	1·75
Ditto, three pieces	—	72	24	76	23	0·62
Ditto, two pieces, enclosing 8 millims. water	—	—	—	0	0	0
Plate glass, of a greenish colour, 10·5 millims. thick	—	55	17	—	20	0
Ditto, 20 millims. thick	—	—	8	—	—	0
Alum, a clear plate, 5 millims. thick	—	18·5	3	—	0	0
Plate glass, slightly greenish, 40½ millims., and clear alum plate, 8½ millims. thick	30	0	0	0	0	0
Calc spar, 27 millims. thick	—	—	—	78	—	—
Very thin film of mica	—	—	off the scale	—	—	8
Ammonio-sulphate of copper, 8 millims. thickness of solution, opaque to rays less refrangible than line F.	72	7	—	0	0	0
Ditto, stronger solution, opaque below G.	29	3	—	0	0	0

oscillation to and fro, showed that the first half, or the maximum deviation produced, whilst under the influence of radiation, occupied about the same time as the second half, or the return swing, when the source of radiation was cut off. The following are the observations. The source of radiation was a candle, the intensity of action being moderated by filtering the rays through glass screens.

Half Oscillation, under Influence of Radiation.	Whole Oscillation, Radiation being cut off during the return swing.
8·00 seconds.	15·00 seconds.
7·50 ,,	15·00 ,,
7·50 ,,	14·50 ,,
7·50 ,,	15·50 ,,
7·50 ,,	14·50 ,,
7·25 ,,	15·00 ,,
7·50 ,,	15·00 ,,
7·50 ,,	15·00 ,,
7·00 ,,	14·00 ,,
7·00 ,,	14·00 ,,
6·75 ,,	14·00 ,,
7·00 ,,	14·00 ,,
7·25 ,,	15·00 ,,
7·00 ,,	14·00 ,,
7·00 ,,	13·25 ,,
8·00 ,,	16·00 ,,
8·00 ,,	16·00 ,,
7·50 ,,	15·00 ,,
7·00 ,,	15·00 ,,
8·00 ,,	15·00 ,,
8·50 ,,	15·50 ,,
7·50 ,,	15·00 ,,
8·00 ,,	15·00 ,,
8·00 ,,	15·00 ,,
7·00 ,,	14·00 ,,
Mean..7·47 ,,	Mean..14·77 ,,

The average time of the first half oscillation is therefore 7·47 seconds,* and of the second half 7·3 seconds. This small difference is not unlikely to be due to errors of observation.

After a long series of experiments the zero gradually creeps up, showing that one side of the apparatus is becoming warmed. The conducting power for heat and condition of the surface (whether coated with lampblack or consisting of polished metal) of the body on which radiation falls materially influence the movements.

109. The accompanying table gives the results of numerous experiments as to the effect of screens, tried with an exceedingly delicate apparatus, constructed as above desribed, the window, *c'* (fig. 7), being of quartz. The candle used was the kind employed in gas photometry, and defined by Act of Parliament as a "sperm candle of 6 to the pound, burning at the rate of 120 grs. per hour." The distances were taken from the front surface of the pith when the luminous index stood at zero. They were in the proportion of 1 to 2 (140 to 280 millims.) to enable me to see if the action would follow the law of inverse squares and be four times as great at the half distance. No such proportion can, however, be seen in the results, the radiant source possibly being too close to allow the rays to fall as if from a point. The figures given are the means of a great many fairly concordant observations. Where a dash rule is put I have tried no experiment. The cipher 0° shows that experiments were actually tried but with no result.

The sensitiveness of my apparatus to heat-rays appears to be greater than that of any ordinary thermopile and galvanometer. Thus I can detect no current in the thermopile when obscure rays from copper at 100° C. fall on it through glass; and Melloni gives a similar result.

(To be continued).

* By referring to paragraphs 106 and 107 it will be seen that I have put the time of the first half oscillation as 11·5 seconds. This was with another apparatus, having a glass thread of different torsion.

ESTIMATION OF POTASSIUM AS ACID TARTRATE.*

By P. CASAMAJOR.

(Concluded from p. 233.)

If we should be in entire ignorance of the quantity of potassium in a compound to analyse, we should take a large quantity of tartaric acid, not more, however, than three times as much as the quantity of material weighed for analysis, as the monosulphide, which is the compound having the greatest percentage of potassium, has 71 per cent, which, multiplied by 4, gives 2·84. The next in order, potassic hydrate, has nearly, but not quite, 70 per cent.

To return to the 10 c.c. of decinormal solution, we may note that they contain 47 centigrms. of potassa, corres-

* Read before the American Chemical Society, September 7, 1876.

ponding to 39 centigrms. of potassium. We may then weigh approximately 2 grms. of tartaric acid, which is a little less than six times the quantity of potassium to be precipitated. This acid is dissolved, and added to our 10 c.c. of decinormal solution. The liquid should now be stirred sufficiently to make a thorough mixture of the solutions of potassa and tartaric acid. The crystals begin to deposit almost immediately, and the deposition increases for about five or six minutes, when it stops, and the liquid clears up. Alcohol should now be added to increase the precipitate. This addition, however, requires a few words of explanation.

As the result of numerous estimations of potassium in compounds of various kinds, I have found it advantageous to add, at first, only a small quantity of alcohol, a volume about one-tenth of the liquid in the beaker-glass. After this addition the liquid should be stirred sufficiently to effect a thorough mixture, and then be allowed to rest five or six minutes, when the liquid above the precipitate becomes clear once more. Finally, the rest of the alcohol should be added, a quantity sufficient to make the whole liquid in the beaker-glass contain at least 60 per cent of alcohol in volume. The liquid in the beaker should be stirred up once more, and after becoming clear it should be thrown on a filter.

To ensure in an easy manner a quantity of alcohol equal to 60 per cent of the total volume of liquid, I mark on the side of a beaker-glass a line corresponding to 50 c.c., which is easily done with a file, previously moistened with petroleum or spirits of turpentine to prevent the abrasion from cracking the glass. 50 c.c. are quite sufficient when we take 1 grm. of material for analysis. The volume of the beaker-glass should be at least 200 c.c. This volume of 50 c.c. is for the solution in water before adding alcohol.

In the case we have on hand, we have dropped 10 c.c. of decinormal solution of potassa in a glass, and added a solution of tartaric acid. We may now add water up to the mark indicating 50 c.c.

On the other hand, we have strong alcohol—say, of 93½ per cent—which is the strongest common alcohol found in the market, and which is sold under the name of 95 per cent alcohol. I have no intention of giving rules for mixtures of alcohol and water, which are familiar to most chemists. In this case I will call your attention to this—that if you add 100 c.c. of 93½ per cent alcohol to the 50 c.c. of liquid in the beaker-glass, the result will be 150 c.c., and if we divide 93½ by 150 the result, 62·3, will be the strength of alcohol required.

After adding about 10 c.c. of strong alcohol to the 50 c.c. of solution in our beaker-glass, we finally add the rest of the 100 c.c. After the deposition of crystals has stopped, the contents of the beaker are thrown on a filter.* The liquid that filters through gives a distinct red colour to litmus paper. The precipitate on the filter should now be washed with alcohol of 60 per cent until the filtered liquid ceases to show a red colour with litmus paper. The precipitate after this is ready to be washed down into a beaker-glass to be tested with potassa, after the liquid in the glass has been sufficiently heated and coloured with litmus. The glass containing cream of tartar in water is placed under a burette, and, if the operation has been carefully conducted, it will take exactly 10 c.c. of the decinormal potassa solution to turn the liquid in the beaker-glass from red to blue.

The condition of a solution containing only potassa and water is one that very rarely, if ever, presents itself in chemical analysis, and we have in the next place to ascertain the influence of bodies which are usually found in combination, or in a state of mixture, with potassium.

If we drop 10 c.c. of a decinormal solution of potassa in a glass, and add a few drops of solution of litmus, we will be able to find the quantity of sulphuric acid, added drop by drop, which will neutralise the 10 c.c of potassa. After doing this, if we add as before 2 grms. of tartaric acid dissolved in water, a very slight precipitate will be obtained, even after standing for hours, and however much the liquid may be stirred, or whatever quantity of alcohol we may add, the precipitate does not increase perceptibly. If, instead of stopping at neutrality, a sufficient excess of sulphuric acid is added, tartaric acid will not show the least turbidity after continued agitation and addition of large quantities of alcohol. Hydrochloric acid in the same circumstances behaves exactly in the same manner, as is also the case with nitric and phosphoric acids. From the behaviour of potassic bromide and iodide, when in presence of an excess of tartaric acid, we must conclude that hydrobromic and hydroiodic acids belong to the same category.

With all these acids, a quantity sufficient for neutralisation of the potassa gives a slight precipitate, while an excess prevents precipitation. In the first case, the precipitate produced can only take place by liberating a quantity of the acid in combination, and after a sufficient quantity of free acid has been formed further deposition is prevented.

The acids experimented on were powerful mineral acids, whose affinities for potassium are so great that, although the acid tartrate is more insoluble than any of their potassic compounds, they only yield a small portion of potassium to tartaric acid. If, therefore, a weaker acid than the tartaric was chosen to combine with potassium, it would not prevent the production of an abundant deposit of acid tartrate. Acetic acid naturally suggested itself, and, on being tried, was found incapable of preventing this precipitation. Here, then, was our way out of the difficulty.

Before describing the manner in which this property of acetic acid was utilised, we must, for the better understanding of the subject, state that salts of sodium in a solution containing 60 per cent of alcohol do not prevent the precipitation of cream of tartar. The sulphate, the nitrate, the chloride, iodide, and bromide, the tartrate, and acetate seem equally powerless to prevent the formation of the precipitate. This is an important point, as by means of soda or its carbonate we may separate the bases that accompany potassium and ammonia, whose acid tartrate is very insoluble, and may in presence of soda be driven off by heat.

The property that acetic acid posseses, of allowing the complete deposition of cream of tartar to take place, suggusted at first the following process:—Given a compound containing potassium, phosphoric acid, if present, would be separated as ammonio-magnesic, as tricalcic, or in any other convenient phosphate. The volatile acids could be driven off by excess of sulphuric acid and heat until fumes of sulphuric acid began to appear. Sulphuric acid could afterwards be precipitated with acetate of barium, thus leaving acetic acid as the only acid in the solution, in combination with all the bases.

This process is simple in theory, but long, and altogether detestable in practice. An analysis was already begun on this plan, when another, much more simple and convenient, suggested itself, which gave on trial the most satisfactory results. This process consists in adding to the compound to be analysed, if it contains a strong mineral acid, a certain quantity of acetate of sodium and, afterwards, tartaric acid. The effect of adding acetate of sodium is that if a strong mineral acid is in excess it forms a sodium salt by acting on the acetate, and liberates a corresponding quantity of acetic acid. When tartaric acid is afterwards added, and a quantity of acid tartrate is precipitated, the strong mineral acid set free reacts on the acetate, and acetic acid is again liberated. This action goes on until all the potassium has been precipitated as acid tartrate, and all the strong mineral acids originally combined with potassium have been combined with sodium, and a corresponding quantity of acetic acid has been set free.

The quantity of acetate of sodium that I usually add is equal to the quantity of tartaric acid. The theoretical

* When soda is present in the solution it is expedient not to delay too much in throwing the precipitate on a filter to avoid errors in the result. I propose in a future communication to examine this question.

quantity necessary is 55 per cent of the quantity of tartaric acid, but I always obtain excellent results by using equal quantities; the excess does no harm.

This action of acetate of sodium, in promoting the precipitation of cream of tartar, is one of importance in testing for potassium qualitatively. In our chemical books we find directions for precipitating potassium from its compounds by means of tartaric acid, as if it was a difficult and delicate operation. An addition of acetate of sodium in conjunction with tartaric acid, and a discreet use of alcohol, will give indications of potassium in a few minutes, even when present in small quantities.

To give an example of analysis of potassium, let us take a sample of chloride, and weigh 1 grm. This is dissolved, and 2 grms. of acetate of sodium are added and dissolved. We now dissolve 2 grms. of tartaric acid, and add them to the mixture of potassic chloride and acetate of sodium. We note the total volume of liquid, and, after the deposition of acid tartrate has stopped, we add about one-tenth as much of alcohol of 93¼ per cent, when a further deposition takes place. Afterwards, the remaining quantity of strong alcohol is added, which must be such that the total volume of alcohol is double that of the original aqueous solution. The precipitated cream of tartar obtained is tested, exactly as before, by a decinormal solution of potassa.

Instead of estimating the precipitate of acid tartrate volumetrically, it may be dried at 100° C., and weighed. The volumetric analysis is, however, preferable, apart from its rapidity and convenience, because by the action of alcohol some compounds, such as sulphates, may in certain cases be precipitated, but as they have not an acid reaction their presence would not interfere with the estimation by a titrated alkaline solution.

To enable me to verify the accuracy of the results obtained by this process of analysis, I have in all cases taken a stated volume of titrated solution of pure potassa, and I have added sulphuric, nitric, and hydrochloric acids, and varying quantities of sodium salts. The potassa dissolved to form a titrated solution was Tromsdorff's potassa by alcohol, containing no soda. The acids leave no residue by evaporation, and can therefore contain no potassium.

By saturating 10 c.c. of potassa solution with sulphuric, hydrochloric, and nitric acids, the following results were obtained. The numbers represent the c.c. of the same potassa solution, which saturated the acid tartrate precipitated in each case:—

SO_4K_2.	ClK.	NO_3K_2.
10·00	10·00	9·90
10·05	10·05	9·85
9·90	9·85	9·95

In making these experiments it was of the utmost importance that my solution of potassa should be pure, but, in commercial tests, it matters little whether the standard alkaline solution be of potassa or soda, as both neutralise cream of tartar.

The process for the estimation of potassium which I have described is not always advisable, as the strength of alcohol required may in some cases interfere with the results. When a great many tests are to be made, as happens in a factory, and at the same time extreme accuracy is not required, the expense attending the use of so much alcohol may be worth consideration.

For 1 grm. of substance weighed for analysis 100 c.c. of strong alcohol are required, besides about 50 c.c. more for washing the precipitate. Altogether, we may calculate that the alcohol for every test costs about 10 cents. In testing the low products of sugar houses for potassium strong alcohol cannot be used, because they contain substances which become adhesive and unmanageable in presence of strong alcohol.

To explain the process that I have used in such cases, let me take once more 10 c.c. of titrated potassa solution in a beaker-glass, and add enough tartaric acid to precipitate the potassium. A certain portion will be deposited, but another part, although converted into cream of tartar, will remain in solution. If the precipitate is thrown on a filter without the addition of alcohol, and if we free it from excess of tartaric acid by washing with water, a further loss will take place. If, instead of using pure water to dissolve the tartaric acid added to our 10 c.c. of potassa solution, and to wash the precipitate of acid tartrate left on the filter, we use a liquid incapable of dissolving cream of tartar the loss would be very much reduced. This we can easily do by using a saturated solution of acid tartrate. When the impurities on the filter have been removed by washing with this saturated solution, the last portion of this solution may itself be removed by washing with a small quantity of alcohol of 60 per cent.

There will then remain one cause of error, due to the water introduced with the 10 c.c. of titrated potassa solution, which may, with sufficient approximation, be considered as 10 c.c. of water. To estimate this quantity, we must use the table of Chancel already given, and if we suppose that the temperature of the liquid is 25° C., we shall find that at that temperature 100 c.c. of water will dissolve 67 centigrms. of acid tartrate, and therefore 10 c.c. will dissolve 67 milligrms., corresponding to 16¾ milligrms. of potassa, and consequently to 0·35 of 1 c.c. of decinormal solution. If we have operated with care, we will find that we can account for the original 10 c.c. of potassa solution within one-tenth of a c.c.

The results, however, are not nearly so accurate when salts of sodium are mixed with the potassa solution, and there is always a deficiency in the acid tartrate precipitated. I found, however, that a small quantity of alcohol will in great part overcome this difficulty, but by using too much alcohol, as much as 10 per cent, the results are too high. After a great many experiments, I have been led to adopt 3 per cent as the strength of alcohol that gives the best results. The quantities of acid tartrate dissolved by 3 per cent alcohol at various temperatures are as follows:—

Temp. C.	100 c.c. of Water having 3 per cent of Alcohol will Dissolve Cream of Tartar. Grammes.
0	0·21
5	0·25
10	0·32
15	0·37
20	0·45
25	0·54
30	0·60
35	0·75
40	0·84

This alcohol of 3 per cent, saturated with acid tartrate, is used to dissolve the potassium compound weighed for analysis, to dissolve tartaric acid and acetate of soda, to dilute our solutions, and wash our precipitates. As the temperature of a laboratory need not vary during an operation, no error need result from the quantities of cream of tartar which alcohol of 3 per cent will take up at different temperatures.

Let us take a low sugar-house product to test for potassa, in the shape of a syrup of 42° B. Suppose we take 100 grms. of this, the quantity of water in our weighed sample will be 20·6 grms. To this we add a quantity of alcohol equal to 3 per cent, or 3·3 per cent of alcohol of 93¼ per cent, which is seven-tenths c.c. We may now dilute our syrup of 42° B. with alcohol of 3 per cent until it is quite thin, and add about 5 grms. of tartaric acid if the low product is from cane-sugar, or about 20 grms. if a beet product. We should also add about the same quantity of acetate of sodium, and after allowing deposition to take place for about fifteen minutes, the precipitate may be treated as we have seen in other cases.

After the acid tartrate has been saturated by the titrated potassa solution, we should add to the result obtained by the burette, the quantity of potassa corresponding to the acid tartrate dissolved by the 20·6 c.c. of water which

accompany the 100 grms. of 42° syrup and the 0·7 c.c. of alcohol added, which are equal to 21·3 c.c. of alcohol of 3 per cent. If the temperature of the liquid at the time of filtration is 30° C., we will find in the table I have given that 100 c.c. of alcohol of 3 per cent will, at that temperature, dissolve 60 centigrms. of cream of tartar, and consequently 21·3 c.c. will dissolve 13 centigrms., which represent 32½ milligrms. of potassa, which should be added to the result.

The process based on the use of weak alcohol, saturated with cream of tartar, is of older date than the process I first described. The results obtained are not uniformly satisfactory, for, although they are generally good, sometimes there will be errors of 2½ or 3 per cent, which cannot be attributed to any cause that I could discover. These discrepancies induced me to try the other process, in which the solutions are made to contain 60 per cent of alcohol, and this has always given satisfactory results.

REPORT
ON THE
DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from p. 233.)

The Sulphur Industry of Sicily.
By Dr. ANGELO BARBAGLIA.

THE true home of sulphur is Sicily, where the deposits extend over a great portion of the island bounded on the south by the mountains Delle Madoni, and comprising almost the whole of the provinces of Caltanisetta and Girgenti as well as a part of Catania as far as Caltagirone, Rammacca, and Centuripe. Besides this there are isolated deposits at Lercara, in the province of Palermo, and at Gibellino, in the province of Trapani. The number of sulphur mines scattered in the above-mentioned provinces is very considerable. According to a statistical conspectus for the year 1872 the number exceeded 250, with a total yearly production of 1,861,700 metric quintals, requiring an outlay of 2,472,935 lire.

Province.	Annual yield in Metric Quintals. Average of 1869, 1870, and 1871.	Expenditure in Italian Lire.
Caltanisetta	781,400	1,264,390
Catania	173,300	326,700
Girgenti	826,200	763,645
Palermo	78,800	118,200
	1,861,700	2,472,935

According to the recent and highly interesting investigations of the mining engineer, Mottura, published in 1871, Sicilian sulphur is a product of the tertiary formation, and is found in the upper miocene between foliaceous crystalline gypsum and massive limestone (calcinari); its associates are bituminous marl (tufi) and gypsum. The sulphuriferous deposits (veins, courses, beds) vary exceedingly in inclination, thickness, extent, and in richness. In these deposits and on their outer boundary, there is invariably found a granular, friable, whitish rock consisting chiefly of gypsum. The miners of the island name this rock briscale, and suppose that from the purity and thickness which it displays on the surface they can infer the richness and extent of the sulphur deposits. The ores are divided into three groups —

	Real Percentage.	Yield.
1. Richest	30—40	20—25
2. Rich	25—30	15—20
3. Ordinary	20—25	10—15

* "Berichte über die Entwickelung der Chemischen Industrie Während des Letzten Jahrzehends."

Prospecting for Sulphur.—The existence of sulphur underground may be almost always concluded from characteristic indications on the surface. As such the *briscale* is especially regarded, and where it crops out to daylight it is as a rule certain to lead to deposits of sulphur. The occurrence of siliceous limestone and of sulphur springs are regarded as favourable indications. The first operation consists in driving strongly sloping adits, known by the native miners as *buchi* or *scaloni*. The latter name refers to the circumstance that they are laid out in stair-like flights, which are distinguished as *sani* and *rotti* according as they run on in a right line, or turn off at an angle.

(To be continued.)

ON A MODE OF GENERATING SULPHUROUS ACID FOR USE AS A DISINFECTANT, &c.

By THOMAS W. KEATES,
Consulting Chemist to the Metropolitan Board of Works, &c.

FROM the remotest time burning sulphur has been employed to fumigate and purify infected air, and to destroy fermentative and putrefactive action. There is no agent mere powerful in its effects than this. Unlike chlorine, it not only acts as a disinfectant or destroyer of disease-germs and of the results of putrefaction, but it is also a powerful preservative agent, and, like carbolic acid, is a preventive of chemical changes in dead organic matter of every kind.

Although the value of sulphurous acid is thoroughly understood, its use is necessarily limited by the difficulty which exists in the way of producing it in a form in which it can be readily applied. The ordinary method of generating it by burning sulphur is cumbrous and very uncertain, owing to the difficulty of keeping up the combustion; there are also many situations in which the process cannot be carried on at all, and under the best circumstances it is inconvenient and but little under control. The evolution of the gas from its solution in water is scarcely more convenient, while it is much less effective; indeed, it may be said that there is no ready, convenient, and easily controllable way of producing this valuable agent in use at present; and this is the more remarkable when it is considered what a ready and simple means we really have at hand for this purpose.

Most of the readers of *The Lancet* are no doubt familiar, at least theoretically, with the substance called bisulphide of carbon. This is a compound of one atom of carbon with two atoms of sulphur (CS_2); it is a dense, mobile liquid, heavier than water, and intensely inflammable, burning in the air like spirit of wine. During combustion the constituents of the bisulphide combine with the oxygen of the air, producing sulphurous and carbonic acid gases; but as 100 parts contain, by weight, as much as 84 parts of sulphur, which will give, in burning, 168 parts of sulphurous acid, it will be seen that the volume of this gas from a given quantity of bisulphide greatly exceeds that of the carbonic acid, and is comparatively very large. Suppose the above quantities to be in grains: as 100 cubic inches of sulphurous acid weigh 68·5 grs., the 168 grs. will measure upwards of 245 cubic inches, or about one-seventh of a cubic foot, which is the volume of sulphurous acid obtainable from 100 grs. of bisulphide.

The bisulphide of carbon can be burned in a common spirit lamp, and in that case the products are sulphurous acid and carbonic acid only, in relative proportion to the atomic composition of the bisulphide, as I have stated; but by a modification of the method of burning, the amount of sulphurous acid produced in a given time can be regulated to any desired extent.

It is a property of the bisulphide of carbon to dissolve in fat oils and hydrocarbon liquids, such as petroleum; so by mixing it with any one of these liquids and burning

the mixture in a properly constructed oil or petroleum lamp, sulphurous acid will be generated with the other usual products of the combustion of such materials, and in proportion to the quantity of bisulphide present in the mixture of combustible liquids; any proportionate quantity of sulphurous acid can in this way be thrown into an atmosphere, and the action may be continued for any length of time.

As the sulphurous gas is generated *pari passu* during the combustion of the bisulphide, it diffuses itself in the air, which in a short time will become completely impregnated with it. In a room containing about 1300 cubic feet of air it was found that by burning 280 grs. of the bisulphide the atmosphere was so far charged with sulphurous acid that it was impossible to remain in the room for more than a few seconds. In five minutes after the lamp was lighted litmus paper began to be reddened at some distance from it; in ten minutes the air had become very oppressive, and the litmus paper was reddened in the extreme corners of the room; in fifteen minutes the air was so charged with the gas that it could scarcely be breathed, and in twenty minutes it was unbearable. In that time, as I have said, 280 grs. of bisulphide were consumed in a simple single-wick lamp.

Sulphurous acid generated in this manner can be applied with facility to the disinfection of any place or object. In the case of rooms in which infectious or contagious disease has prevailed, it is only necessary to light the lamp and allow it to burn until the atmosphere has become impregnated with the gas to any desired extent, and then to remove or extinguish it just like a common spirit lamp. In the simple form of apparatus which I suggest for this purpose, the lamp is enclosed in a metal case, about 3 inches in diameter and 8 or 9 inches high, furnished with holes near the bottom for the admission of air, and others in the top for the emission of the sulphurous gas. This can be conveniently moved about, and placed, while the lamp is burning, in almost any locality. Receptacles for infected clothing, or the clothes or linen used in connection with disease, or carriages which have conveyed fever or other patients, can be thoroughly purified without difficulty and with very little trouble. For the disinfection of ships, too, the lamp is particularly suitable, as it can be carried into the remotest part of a ship and burned without the least danger, and with the certainty of effecting its object completely.

It must be observed that the bisulphide of carbon is extremely volatile, having its boiling-point as low as 110° F.; it is therefore necessary that the lamp in which it is burned should be furnished with a well-fitting screw-cap, to prevent the liquid from evaporating, and at the same time to keep its peculiar odour from escaping. This odour is often very nauseous, but the bisulphide is now manufactured by Messrs. C. Price and Co., of Thames Street, so pure, that it possesses very little smell, and can be used without the least inconvenience.—*The Lancet.*

Printing-House Square.

PROCEEDINGS OF SOCIETIES.

PHYSICAL SOCIETY.

November 2nd, 1876.

Professor G. C. FOSTER, F.R.S., President, in the Chair.

THE following candidate was elected a member of the Society:—G. Waldemar von Tunzelmann.

M. JANSSEN made a brief communication, in French, with reference to a method which he has proposed to the Académie des Sciences for ascertaining whether planets really exist between Mercury and the Sun. After mentioning the importance of photography from an astronomical point of view, he explained his reasons for hoping that a series of solar photographs—taken regularly at intervals of about two hours, at a number of places on the earth's surface—would enable us to determine this question which is now agitating the scientific world, since any spots which crossed the sun's disk would be at once registered. As it is necessary that such observations be made at several places and in several countries, M. Janssen hopes that other countries besides France will ere long arrange to have such a series of observations taken, and he considers that in a few years the circumsolar regions would thus be explored with a certainty which could not possibly be attained by any other method. He exhibited some of the original photographs taken in Japan of the transit of Venus, and explained the advantage of placing a grating in the focus of the camera in order to eliminate distortion.

Mr. CROOKES showed the spectrum of a small specimen of chloride of gallium which he had received from its discoverer, M. Lecoq de Boisbaudran. The discovery of this metal is of peculiar interest, as M. Mendeleef had previously, from theoretical considerations, asserted it to exist, and had also correctly given some of its chemical and physical properties. The most prominent line in the spectrum was a bright line in the blue, somewhat more refrangible than that of indium.

Mr. LODGE briefly described a model he has designed to illustrate flow of electricity, &c., which is fully explained in a paper in the *Philosophical Magazine* for November, and he showed how similar considerations can be applied in the case of thermo-electric currents. The model in its simplest form consists of an endless cord passing over four pulleys, and on one side of the square thus formed it passes through a series of buttons held in their positions by rigid rods or elastic strings, according as they represent layers of a conducting or non-conducting substance. When considered in connection with thermo-electricity the buttons are assumed to oscillate on the cord, and if they move in one direction with greater velocity than in the other, the cord will tend to move in the former direction. Now, at a junction of copper and iron, since the metals have different atomic weights and their kinetic energies are equal, the velocities must differ on each side of the junction, and an unsymmetrical oscillation of the molecules must ensue, analogous to that assumed by Mr. Stoney to take place in Crookes's radiometer, and the cord, or electric current, will advance when two junctions are at different temperatures. Mr. Lodge showed experimentally that for a given difference of temperature the maximum thermo-electric current is obtained when one of the junctions is at 280° C., and beyond this point the amount of deflection decreases. This fact led Sir W. Thomson to discover the convection of heat by electricity; that is, if we have a circuit composed of copper and iron, and one of the junctions is at the above temperature, the current, in passing from hot to cold in the iron or from cold to hot in the copper, absorbs heat. This fact was experimentally illustrated by Mr. Lodge. A strip of tin plate is symmetrically bent so as to nearly touch the two faces of a thermopile, and is heated at the bend by steam passing through a brass tube on one side (not end) of the thermopile, and kept cold by a current of water on the other side. As the arrangement is symmetrical no current is found to pass through the thermopile, but when a powerful voltaic current passes through the strip of metal a reversible deflection of the needle is observed, in accordance with the above law.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, October 17, 1876.

E. W. BINNEY, F.R.S., F.G.S, President, in the Chair.

MR. BAXENDELL drew attention to a paper, "On the Protection of Buildings from Lightning," read by Prof. J. Clerk Maxwell at the late meeting of the British Associa-

tion at Glasgow, and stated that the system of protection recommended by the Professor, and which he appears to have regarded as new, was suggested, and its adoption strongly advocated, nearly forty years ago by the late Mr. Sturgeon, whose many valuable contributions to electrical and magnetical science seem to have been strangely overlooked by recent investigators and writers. The paper in which the system was first described was read before the London Electrical Society on the 7th of March, 1838, and an abstract of it was published in the second volume of the "Annals of Electricity." There is, however, one important difference between the two systems. Mr. Sturgeon considered it necessary that the copper sheathing or covering of a protected room or powder magazine should be well connected with the ground; but Prof. Maxwell is reported to have stated that "there would be no need of any earth connection. They might even place a layer of asphalte between the copper floor and the ground, so as to insulate the building." It is obvious, however, that if the magazine were struck by lightning a disruptive discharge through the layer of asphalte would in all probability take plate, which might rupture the copper sheathing, and thus ignite the contents of the magazine; but by the adoption of Mr. Sturgeon's plan an accident of this kind could not occur.

Remarkable Meteor.—The President said that on Tuesday, the 15th of August last, whilst standing on the deck of the packet in Douglas Bay, in the Isle of Man, he observed one of the most brilliant meteors that he had ever seen. At about 35 minutes past 9 o'clock p.m., Greenwich time, he was looking towards the west, when he observed a body, apparently larger than the planet Jupiter, in the S.S.E., at an elevation of about 30° with the horizon, traversing the heavens at first in a nearly horizontal direction, then gradually declining, and finally disappearing by a steep curve to the N.N.W. When first observed it appeared to be of a yellowish colour, but it changed to a greenish blue before it sank out of sight. During its last stage it reminded him of a large Roman candle, and from its great brilliancy appeared to be not very far from the place where he stood, but he observed no signs of its bursting, and it left little trace of a luminous track behind it. The speed at which it travelled appeared to be less than that of most meteors which he had observed.

This meteor appears to have been observed by several parties, for Mr. J. P. Norris wrote to the *Times* from Abbey House, Bristol, under date of August 15—"A brilliant meteor has this moment fallen due west of this house. It first appeared in the neighbourhood of Arcturus, then seemed to burst, and trail light of rainbow colour, and was visible to near the horizon slanting towards the north. Its distance cannot have been great, for we saw it throughout two-thirds of its course against a dark cloud. It may have fallen, therefore, in the neighbourhood of Clevedon." A correspondent, writing from Further Barton, Cirencester, on Wednesday, says—"At about 9.30 yesterday evening (15th) a magnificent meteor was seen from this place, passing slowly across the north-western heavens about midway between Arcturus and the horizon. The colour was vivid pale green, it left a greenish wake behind it, and burst with brilliant scintillations of whiter light;" and another says—"At 9.30 last night, Greenwich time, I saw the finest meteor or fire-ball that it has ever been my fortune to observe. It passed just below E. Bootes, and travelled northwards in a descending direction between A. Canes Venatici and the large cluster in Coma, rather nearer the latter. It exactly resembled the globe of fire projected by a Roman candle; the colour was of a brilliant yellow, and then after changing to a vivid green the meteor disappeared. The ball was pure, and unattended by luminous track."

He gave the above particulars to show how observers were deceived as to the distance of meteors. The party who observed the one on the 15th of August near Bristol thought that it fell near Clevedon, while he (the President) seeing it at Douglas, 220 miles N.N.W. of that city, imagined it at no very great distance from him. He brought the matter before the Society for the purpose of enquiring whether the meteor had been observed by other parties, especially residents in Belfast or Glasgow, in order to ascertain if it had been seen westwards of those two places.

Mr. A. M. Worthington described the changes which take place in the forms of drops of liquids falling vertically on a horizontal surface, and exhibited the apparatus used in his experiments, and also a series of smoked glass plates bearing the impressions produced by the falling of drops of liquids from different heights.

NOTICES OF BOOKS.

Familiar Letters on the Mysteries of Nature and Discoveries in Science. By Dr. T. L. Phipson. London: Sampson Low, Marston, Searle, and Rivington.

In this book the reader is introduced to a number of subjects lying somewhat away from the beaten tracks of science, and often overlooked in our popular treatises. The author discusses the *ignis fatuus*, electric fogs, the chemistry of the ocean, the science of sleep, plant motion, firestones, atmospheric electricity, lightning-prints, earthquakes, luminous animals, aërolites and inhabited planets. These topics he handles in a suggestive manner; he places facts in a novel light, and often shows the questionable character of our stereotyped explanations of natural phenomena. The Will-o'-the-wisp, he tells us, is, in England, most common "in the peaty districts around Port Carlisle, in Cumberland;" and on the Continent, "in the damp valleys between the pretty little university town of Marburg and that of Cassel, and more certainly still in the grave-yards outside the town of Gibraltar." He points out that the phenomena must be clearly distinguished from the "more or less stationary flames of ignited naphtha springs," common in the East and in Italy, and occasionally visible in Herefordshire and Lanarkshire. From his own observations, as well as from the evidence of Dr. Dereham, he rejects the view of Ray, Willoughby, Kirby, and Spence, who attributed this phenomenon to swarms of luminous insects. These, he declares, "rise far higher in the air than does the Will-o'-the-wisp, and present the appearance of hundreds of little specks of light." He ascribes the flame to an escape of marsh gas, through which a small quantity of phosphuretted hydrogen is diffused, and considers that wherever the wisp manifests itself, there lies the corpse of some animal. This view agrees well with the provincial name of "corpse-candle," and with a number of popular traditions. Folklore, however, records also cases where the spectator of a wisp has received a sudden blow or shock, and this, as the author suggests, points to electric phenomena of a nature perfectly distinct from the true wisp, and closely related with the fire of St. Elmo.

On fogs—a subject of peculiar though painful interest to dwellers in London—Dr. Phipson gives much curious information. He even suggests a method for their dispersal. "In order to disperse the dense electro-positive London fogs it would be necessary to supply them with an *abundant* source of electro-negative electricity more quickly than the earth usually supplies it. In the present state of electrical science I imagine such a thing to be far from impossible." Dry electro-negative fogs are supposed, on imperfect evidence, to be connected with the appearance of certain diseases. "A dry blue mist of this kind was noticed in London, in 1832, 1854, 1866, during the period of cholera; and the yellow kind has been known to accompany epidemics of scarlatina." Such fogs are not dispersed by rain and wind. On the evening of July 24th, 1872, "when a tolerably stiff breeze from the S.E. was blowing, I found that it was impossible to see the tree

on the towing-path from Putney Bridge." The author has never been able to obtain decided indications of ozone during the prevalence of an electro-negative fog, "but sometimes electro-positive fogs have shown no ozone either in spite of the strong suffocating odour which often accompanies them. This would argue in favour of the existence at certain periods of antozone in the air—a fact which it would be exceedingly interesting to place beyond a doubt."

In the chapter on the "chemistry of the ocean" the curious fact is noticed that one half of all the known elementary bodies have been recognised in sea-water. We learn also that the waters of the Caspian, which has no known outlet, are yet, unlike those of the Dead Sea and of the Great Salt Lake, less salt than the Ocean. We turn next to a letter on the "science of sleep, somnambulism, and anæsthesia." Here, *apropos* of a certain theory propounded to account for the periodical recurrence of sleep, we find the following important and most truthful remark:—

"It is a notorious fact that medical men, whose knowledge of chemistry is necessarily, in most cases, somewhat limited, are very fond of getting behind a chemical screen when confronting a difficult physiological problem; in like manner certain chemists, whose acquaintance with mathematics is of a most elementary nature, are prone to shield their incapacity of dealing with troublesome facts by erecting screens of mathematical formulæ, or abstruse chemical formulæ, as nearly as possible allied to them, which they create for the occasion, losing sight of nature altogether, and dealing, like our sensation-novel writers, with the products of their imagination." We fear that certain neo-chemical luminaries will be apt to exclaim with Costard, "me," "still me" as they read this passage.

In a chapter on the marvels of applied electricity Dr. Phipson remarks that "Man's command of fire at once distinguished him from the rest of animated creation. In the higher classes of apes and monkeys, for instance, although we do not observe so great a dread of fire as we see manifested by quadrupeds, yet there is not a monkey, however highly organised, that has the slightest power over fire. I recollect a scene narrated by the captain of a ship that was wrecked on the coast of Madagascar. The crew made a large fire in the woods at night, and having withdrawn from the blazing embers they secreted themselves in order to observe what the monkeys would do with the fire. As soon as the sailors had retired, numbers of these agile beings leaped from the boughs and approached the fire, the warmth and glare of which they appeared to enjoy. They approached nearer and nearer as the fire gradually burnt out, but not one had the intelligence to throw in a single bough to keep the fire alive, though numerous logs and sticks were scattered upon the ground." The only fault we have to find with this narrative is that there are no monkeys in Madagascar, whilst the lemurs, which, to some extent, take their place, are but ill-organised for throwing logs or sticks upon a fire.

According to Dr. Lening, M. de Romas, and Arago, the problem of transforming thunder clouds, and thus preventing the formation of hail has been solved, and all that is required is that our knowledge should be reduced to practice. The damage done by hail in the south of France in a single storm has been known to amount to a million sterling. An interesting application of electricity is the rendering sea-water, &c., potable by passing through it a current from the battery. The author has not unsuccessfully experimented on this question at Ostend.

In his letter on earthquakes, Dr. Phipson remarks that in his opinion "enough stress has not been laid upon the *constant presence of sulphur* among the products of volcanic action . . . In earthquakes we have constantly a suffocating *smell of sulphur* or *sulphurous gas*, and the same occurs in intense *thunder storms*, especially when the lightning strikes an object on the earth's surface. We have not yet the key to this enigma." In pointing out the imperfection of our knowledge concerning the causes of earthquakes, Dr. Phipson indulges in a strange, and we cannot help saying a most unscientific remark:—"What a field is here open to our young geologists if they can be persuaded to abandon collecting fossils and petrifactions!" Why we should abandon the observation of any class of natural objects is to us a mystery.

There is a very curious chapter on "lightning-prints." The term needs a little explanation. Occasionally it happens that when men or animals have been struck by lightning, and especially if killed, peculiar impressions have been left upon their bodies, which seem to be the impress of some adjacent object. Many of the accounts of phenomena of this kind are either altogether mythological or much exaggerated. Thus, according to the Abbé Lamy, "on the 18th July, 1689, lightning struck the tower of the church of St. Sauveur, at Langy, in France, and printed upon the cloth of the altar some Latin words of a prayer book. The words *Qui pridie quam puteretur*, to the end of the prayer were all reproduced, with the exception of *Hic est corpus meum* and *Hic est sanguis meus*, which in the book were printed in red ink." In 1786, Leroy, a member of the French Academy of Sciences, announced that Benjamin Franklin had frequently told him, some forty years previously, the case of a man who, whilst standing at his door during a thunder-storm, saw the lightning strike a tree opposite to him. It was afterwards discovered that a reversed image of the tree was indelibly imprinted upon the breast of that man. A Mr. James Shaw relates a case which had occurred in 1812. Six sheep feeding in a small pasture surrounded by a wood at Combe Bay, near Bath. They were killed by a flash of lightning, and when flayed "the inside of each skin bore a very faithful image of the surrounding landscape."

The following case is fully authenticated:—In 1836, a young man was killed by lightning near Zante. He had around his body a belt containing some gold pieces, and the images of some of these were indelibly printed upon his right shoulder. The impressions produced, however, were not fac similes of the gold pieces, but circles of three different dimensions, corresponding exactly in size with the three kinds of pieces of money in the belt. Impressions appear also to have been produced in some cases upon inanimate bodies. Thus, according to Professor Andreas Poey, lightning engraved upon the dry leaves of a palm tree in Cuba the representation of some trees growing at the distance of 340 yards. Further observation is here wanted and may both extend our knowledge of the properties of electricity and lead to useful application.

Treating of "life on the earth" the author shows that its correlation with the physical "forces," if modern word splitters will allow us the use of the term, is incomplete. Life, indeed, may produce heat, light, electricity, and chemical action, but it has never, within our observation, been produced by them. Turning to the duration of life he considers, quoting the well-known case of Cornaro, that sobriety is its most essential condition. It must, however, be remembered that Cornaro does not appear to have been a hard worker. The quantity of food sufficient for a man whose days are spent in the *dolce far niente* must necessarily be quite insufficient for persons whose brains or whose muscles are kept in constant exertion. We do not believe that in these days "the generality of people eat far too much."

The proportion of the time of gestation and of the subsequent growth of the young animal to the duration of its life is next considered. But it is an exceedingly difficult thing to determine the average natural life of an animal in a wild state. In captivity or domestication so many disturbing influences come into play that the result is of doubtful value. And, supposing that the time of gestation bears any fixed proportion to the normal period of life, is there any *a priori* reason for affirming that the same ratio must prevail in all the different divisions of the animal

kingdom? As to the time of growth we know already that it bears no constant proportion to the duration of life. In mammals and birds the period of maturity is much longer than the period of growth; but in many insects, *e.g.*, the goat-moth and the cockchafer, it is very much shorter. This chapter of his work Dr. Phipson concludes with the following passage:—

"Those men who abide by experiment and observation, and who simply record their scientific experience, are not likely to shock the religious opinions which govern so many of their fellow creatures; it is otherwise with those who indulge in speculative theories and who attempt to explain everything in their manner. *These are only bigots and fanatics in another form, and they deserve the odium which they draw upon themselves from the opposite extreme of humanity.*"

We cannot agree with this passage; observations and experiments "pure simple" will arouse persecution the moment their results are seen to clash with ecclesiastical tradition. In the very next chapter Dr. Phipson declares:—"When the latter (Galileo) began to give the world the benefit of his observations he was most villanously persecuted." With theories, geological, biological, or astronomical, theologians have, as such, no right to interfere. In a manner strictly analogous physicists, geologists, and the like have no claim to dogmatise on religious questions. We have always denounced every attempt made by either body to exceed its boundaries, but we cannot forget that the first transgression of this nature was made by the theologians.

But there can be no need for us further to multiply either extracts or comments. Whoever has followed us so far will admit that Dr. Phipson's "Familiar Letters" abound in facts not generally known and in interesting reflections. Though popularly written, in the sense of being free from the cumbrous terminology now so much affected, they may be advantageously read by the professed man of science as well as by the person of ordinary culture, and will certainly set both thinking.

CORRESPONDENCE.

ESTIMATION OF POTASSIUM BY MEANS OF ACID TARTRATE.

To the Editor of the Chemical News.

SIR,—In the CHEMICAL NEWS (vol. xxxiv., p. 231) you publish the first portion of a paper by Mr. P. Casamajor, on the "Estimation of Potassium by means of Acid Tartrate." He claims special applicability for his method to the estimation of potash in the syrups of sugar-houses. In the *Sugar Cane* for October 1st, 1874, I inserted a short paper, for the use of foremen or others employed in such houses, containing a description of the same plan of working, adapted to the facilities and time at their command. With the platinic chloride at our call in the laboratory, it seemed useless to attempt any elaboration of the tartaric acid mode of estimation, which may, in its own sphere, be a useful aid to those seeking for a rapid means of assaying the probable ash in syrups. In the same number of the *Sugar Cane*, or the previous one, there is a paper by Mr. Casamajor on the "Expansion of Sugar Solutions by Heat," so he could hardly be quite ignorant of the appearance of mine. I append a copy of my paper.—I am, &c.,

ROBERT FRAZER SMITH.

Glasgow, December 2, 1876.

"The following is the description of an easy and fairly correct practical method for the estimation of potash in syrups and sugars. It is assumed, as a general rule, that two-fifths of the weight of ash present in sugars and syrups, as found by incineration, is potash, and in the majority of instances this assumption is a correct one. It is almost impossible for many persons employed in sugar-houses to find time or opportunity for an ash estimation by the ordinary method, but a correct knowledge of the potash percentage—besides its value as an adjunct to the Duncan and Newlands process—affords also the means of finding the total ash. The potash percentage is readily found thus by any intelligent workman:—Weigh 100 grms. of syrup in a beaker; add 30 c.c. alcohol and 30 c.c. water, containing in solution about 15 grms. tartaric acid. Stir vigorously for a few minutes; then allow the mixture to rest for about half-an-hour. Collect the precipitate upon a tared filter, allow it to drain, then wash with other 60 c.c. mixed alcohol and water. Dry in a water-bath, and weigh. One-fourth of the precipitate is potash.

$$\frac{\text{Potash} \times 5}{2} = \text{total ash.}$$

"The following are estimations made by this method as compared with the ordinary ash estimations made in the laboratory:—

Ash found.	Potash calculated as 5th of Ash	Potash calculated from Acid Tartrate weighed.
5·16	2·06	1·94
5·44	2·17	1·83
6·33	2·53	2·43
7·63	3·05	3·01
8·26	3·30	3·62
8·19	3·27	3·69
6·83	2·73	2·74
6·17	2·46	2·23
7·12	2·85	2·97
4·70	1·88	1·81

"In the event of any doubt being entertained of the purity of the collected bitartrate, incinerate 5 grms. in a platinum capsule, boil the resulting black flux in water, filter and wash the carbon thoroughly, and titrate the filtrate in the usual way with normal acid. This could only be necessary when much lime is present in the syrup—a most unlikely thing to happen in this country.

"Greenock, August 15, 1874."

PROFESSOR WÖHLER.

To the Editor of the Chemical News.

SIR,—The leading members of the executive of the German Chemical Society in Berlin have nominated the veteran Prof. Wöhler President of the Society for the coming year.

I feel that the announcement will be hailed with delight by every chemist, and I beg you to allow me the opportunity of pointing out to such of our craft as are members of that excellent society that they are entitled to vote at the election of President; and that they should not neglect to give expression to the respect and admiration all must feel for the illustrious chemist by sending *without delay*, by post-card or letter, to the present President or one of the Secretaries of the Society, in Berlin, a short statement, signed and dated, to the effect that they give their votes in favour of Prof. Wöhler.—I am, &c.,

WALTER FLIGHT.

Savile Club, 15, Savile Row, W.,
December 6, 1876.

THE SOCIETY OF PUBLIC ANALYSTS.

To the Editor of the Chemical News.

SIR,—I had hoped that I might be spared the necessity of following the example of the Treasurer and one of the Vice-Presidents of the Society of Public Analysts in resigning, before the expiration of my year of office, my position as President, and also my membership, in the

Society, but the occurrence of another in addition to several previous acts of irregularity in the performance of the secretarial duties, and the disapproval I entertain and have expressed, without effect, of these and of the manner in which the editorial duties have been conducted in connection with the Society, have caused me now at once to tender my resignation, and thus to express to the members of the Society my reason for so doing.—I am, &c.,

T. Redwood.

17, Bloomsbury Square, W.C.,
December 5, 1876.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Bulletin de la Societe Chimique de Paris,
Nos. 8 and 9, November 5, 1876.

Decolouration of Indigo by Hydro-sulphurous Acid and by the Persulphide of Hydrogen.—M. E. Schaer.—It is generally admitted that the decolouration of indigo by these agents is due to its transformation into white indigo, and, in fact, mere agitation in the air suffices to restore the blue colour. But certain experiments seem to show that the decolouration is produced by the formation of a colourless molecular compound. For indigo decolourised by hydro-sulphurous acid is regenerated, not only by the action of air and oxidising agents, but also by decided reducing agents, such as sulphuretted hydrogen. Further, indigo bleached by the persulphide of hydrogen is restored by the action of sulphurous acid. These phenomena are explained by the decomposing action of sulphuretted hydrogen upon hydro-sulphurous acid, and of sulphurous acid upon persulphide of hydrogen. We may, then, admit that indigo combines with hydro-sulphurous acid and persulphide of hydrogen, forming colourless compounds, which are destroyed with liberation of the indigo by all agents capable of destroying either hydro-sulphurous acid or persulphide of hydrogen.

No. 10, November 20, 1876.

New Researches on Gallium.—M. Lecoq de Boisbaudran.—Already noticed.

Remarks of M. Boutlerow on a Note by M. L. Henry relating to the Fixation of Hypochlorous Acid upon Isobutylen.—M. Boutlerow remarks that M. Henry has merely confirmed his researches, conducted nine years ago.

Dissociation of the Bicarbonate of Soda at the Temperature of 100°; a reply to M. Gautier.—M. V. Urbain.—The author maintains, contrary to the opinion of M. Gautier, that if dried plasma is exposed to the temperature of 100° the bicarbonate of soda which it contains is not decomposed.

Stains Produced by Sulphocyanic Acid.—M. Pierre Miquel.—The author finds that sulphocyanic acid produces upon paper free from iron a carmine-red spot, which disappears spontaneously on exposure to the air, and more rapidly if a gentle heat be applied. Ammoniacal vapours destroy the colour immediately, and hydrochloric gas restores it. Thus a test-paper is obtained far more sensitive than litmus.

Nitro- and Amido-Naphthyl-Sulphurous Acids, and on their Derivatives.—P. T. Clève.—Not suitable for abstraction.

Correspondence from St. Petersburg, April 12, 1876.—W. Louguinine.—The second part of the eighth volume of the *Journal of the Russian Chemical Society* contains the following papers:—M. A. Zagoumenny has obtained diphenyl-carbinol by the action of alcoholic potassa upon benzo-phenon at 160° in sealed tubes. M. E. Wagner, on behalf of MM. A. Zaytzeff and P. Sorokine, describes researches on the action of iodide of allyl and of zinc upon acetic ether. M. Menschoutkine communicates, on behalf of M. L. Lound, his studies on the transformation of cane-sugar when its aqueous solutions are heated. He finds that these solutions are inverted when heated to 100° in presence of air. If heated in the absence of air, or in presence of air perfectly purified, there is no transformation. Nitrogen and oxygen have no action; carbonic acid acts more fully than air. The transformation must be ascribed partly to the carbonic acid, partly to other substances in the atmosphere not yet determined. M. Menschoutkine, on behalf of MM. F. Wreden and Znatowich, announces that hexa-hydrocymen and decahydro-naphthalin are obtained in the action of hydriodic acid upon naphthalin. The same chemist communicates, on the part of M. G. Fudakovski, an examination of saccharine matters containing galactose. M. Beilstein, on behalf of Dr. Cech, communicates a notice of the colouring power of viridic acin, which he recommends as a colour for esculents (a very old suggestion). M. A. Borodine communicates, on the part of M. Schalfeieff, researches on the cerotic acid extracted from bees'-wax. The acid obtained by Brodie's method is a mixture. M. Idanoff communicates researches on diethyl-methyl-acetic acid, an isomer of œnanthylic acid. There is, further, papers on the electrolysis of the aqueous solutions of oxalic acid, by M. N. Bunge; on the differences observed between starches of different origin when submitted to diastatic action, by M. A. Dobroslavine; on the action of the saliva on divers kinds of starch, by Dr. Georgiefsky; and on the action of iodide of allyl and zinc upon oxalate of ethyl, by M. Michel Zaytzeff.

Absorption-Spectra of different Colouring Matters and Metals of the Iron Group, with Applications.—This paper, which is taken from the *Berichte der Deutsch. Chem. Gesell.* (viii., 1246 and 1533), is incapable of useful abstraction.

Revue Universelle des Mines,
July and August, 1876.

Fermentation of Urine.—M. Leon Krafft.—This paper treats of the preparation of ammoniacal salts from the drainings of cesspools. These liquids are either mixed with sulphuric acid or filtered over sulphate of lime, the result being in either case the conversion of the volatile carbonate of ammonia into the fixed sulphate. The liquid, rendered limpid and clear either by settling or filtration, is evaporated down to one-tenth of its volume either over the naked fire, or by the "graduation" principle. It is then absorbed by a powder composed of turf, bone-black, mineral phosphate of lime, and baked gypsum.

Moniteur Scientifique, du Dr. Quesneville,
November, 1876.

Chemical Patents taken out in France during the Year 1875.—A list of the titles of patents.

Determination of Tannin.—G. Pouchet.—The author passes in review the processes known, and gives the preference to titration with permanganate in an alkaline solution.

On Rosolic Acid.—MM. Graebe and Caro.—Taken from *Liebig's Annalen.*

Contributions to a Knowledge of Rosaniline.—E. and O. Fischer.—From the *Berichte der Deut. Chem. Gesell.*, ix., p. 891.

Duchemin's Compass with Circular Magnets.—A commission of naval officers appointed to enquire into the merits of this invention has reported decidedly in its favour.

Preparation of Thallium.—Dr. R. Nietski.—The author is not satisfied with the method of Krause. He takes the chloride of thallium, moistens it with water slightly acidulated, and adds a few fragments of zinc. After a few days all the thallium is separated in a spongy

mass, which is carefully washed, and dissolved in hot dilute sulphuric acid. The foreign metals and the other impurities remain undissolved. A pure and concentrated solution of sulphate of thallium is thus obtained, from which the salt may be separated by crystallisation, and the metal may be obtained either by a galvanic current or by means of zinc.

Dyeing Aniline-Blacks.—M. Allard.— The author protests against the claim set up by M. Grawitz to be the first inventor of the process for dyeing aniline-blacks without exposure to air, the colour being due to the formation of double salts of aniline peroxidised by chlorates or chromates.

MISCELLANEOUS.

University of London.—The following gentlemen have passed the recent Second B.A. and Second B.Sc. examinations:—*Examinations for Honours* (*B.A. and B.Sc. conjointly*); *Mathematics and Natural Poilosophy*.—First class. J. S. Morris, B.A. (Scholarship), St. John's College, Cambridge; J. F. Main, B.Sc., Trinity College, Cambridge. Second class. S. White, B.A., University College. *Chemistry* (*B.Sc. only*).—First class. J. K. Crow (Scholarship), Owens College. Second class. W. W. Jones, Magdalen College, Oxford. *Geology and Palæontology*.—First class. W. Hewitt (disqualified by age for the Scholarship), Royal School of Mines; J. K. Crow (Scholarship), Owens College; A. R. Willis, Royal School of Mines. Second class. J. Monckman, Yorkshire College of Science; A. E. Tovey, private study.

Royal Institution of Great Britain.—The following are the arrangements of the Lectures before Easter, 1876:—

Prof. John Hall Gladstone, Ph.D., F.R.S.—Six Lectures adapted to a juvenile auditory, on the "Chemistry of Fire;" on Dec. 28 (Thursday), 30, 1876; Jan. 2, 4, 6, 9, 1877.

Prof. Alfred H. Garrod, M.A., F.R.S.—Ten Lectures on "The Human Form; its Structure in relation to its Contour;" on Tuesdays, Jan. 16 to March 20.

Dr. C. R. Alder Wright, F.C.S.—Four Lectures "On Metals, and the Chief Industrial Uses of these Bodies and their Compounds;" on Thursdays, Jan. 18 to Feb. 8.

William Pole, F.R.S., Mus. Doc.—Six Lectures "On the Theory of Music;" on Thursdays, Feb. 15 to March 22.

Mr. Ernst Pauer.—Two Lectures "On the Nature of Music: the Italian, French, and German Schools;" on Saturdays, Jan. 20, 27.

Mr. J. A. Symonds.—Three Lectures "On Florence and the Medici;" on Saturdays, Feb. 3 to 17.

Prof. Henry Morley.—Five Lectures "On Effects of the French Revolution upon English Literature;" on Saturdays, Feb. 24 to March 24.

The Friday Evening Meeting will begin on Jan. 19, 1877, at 8 o'clock; the Discourse by Prof. Tyndall at 9 p.m. The succeeding discourses will probably be given by Prof. Huxley, Prof. Osborne Reynolds, Mr. Francis Galton, Prof. F. Guthrie, Mr. J. F. Moulton, Sir John Lubbock, Mr. Frederick J. Bramwell, and others. To these meetings Members and their friends only are admitted.

Early Closing amongst Chemists and Druggists.—A conference of chemists in the Notting Hill District, who were favourable to earlier hours of closing, was held on Friday last in the Mall Hall, the Mall, Notting Hill. Messrs. Johnson (Twinborrow), Westbourne Grove, Chas. Butler, Faulkner, Baker, Grosvenor, Long, H. Long, Drury, &c., attended, and also Messrs. E. Kennedy and F. A. Allen, Secretaries, Early Closing Association. The following resolutions were adopted:—Proposed by Mr. A. P. Baker, seconded by Mr. C. H. Grosvenor:—"That in the opinion of this meeting the business hours observed by the chemists and druggists of this neighbourhood are unduly prolonged, and might be curtailed without inconvenience to the public or prejudice to the trade, whilst conferring great benefit upon employers and employed." Proposed by Mr. S. Drury, seconded by Mr. C. Butler:—"That the chemists and druggists present, being convinced of the benefits to be derived from the adoption of earlier hours of closing, hereby form themselves into a provisional committee (with power to add to their number) for carrying out the object of the meeting." Proposed by Mr. R. A. Johnson, seconded by Mr. J. R. Faulkner:—"That the foregoing resolutions be forwarded to the Press, and to the various chemists and druggists of the locality, with a view to their co-operation in the movement." The proceedings terminated with a vote of thanks to the Chairman. The next committee meeting is fixed for Wednesday, December 13, at the same time and place.

The Newcastle Institute of Mining and Mechanical Engineers.—We are glad to announce that this useful institute has lately received the honour of being incorporated by Royal Charter.

MEETINGS FOR THE WEEK.

MONDAY, 11th.—Society of Arts, 8. (Cantor Lectures.) "The History of the Art of Coach Building," by Mr. G. A. Thrupp. Lecture IV.—Ancient and Modern Travelling and Public Carriages of Europe.
—— Medical, 8.
—— London Institution, 5
—— Royal Geographical, 8.30.
TUESDAY, 12th.—Civil Engineers, 8.
—— Photographic, 8.
—— Anthropological Institute, 8.
—— Manchester Literary and Philosophical, 7.
WEDNESDAY, 13th.—Society of Arts, 8. "A New Process of Printing a Number of Colours at one Impression," by E. Meyerstein.
THURSDAY, 14th.—Royal, 8.30.
SATURDAY, 16th.—Physical, 3. "An Experimental Contribution to the Theory of the Radiometer," by W. Crookes, F.R.S. "On a Capillary Electrometer," by Prof. J. Dewar, F.R.S.E.

TO CORRESPONDENTS.

E. H. Cook.—Received with thanks.

J. W. M.—Mr. Smith's letter renders the publication of yours unnecessary.

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THE CHEMICAL NEWS.

VOL. XXXIV. No. 890.

ON REPULSION RESULTING FROM RADIATION.—PART II.*

By WILLIAM CROOKES, F.R.S., &c.

(Continued from p. 242).

110. An examination of this Table shows that the action is by no means confined to the rays usually called heat, *i.e.*, to the extreme- and ultra-red of the spectrum. The strong action obtained when the light is filtered through greenish glass and alum, or through ammonio-sulphate of copper, shows that luminous rays produce a similar movement of repulsion.

Unfavourable weather has prevented me from obtaining good quantitative results with the different rays of the solar spectrum; but I have tried numerous qualitative experiments which leave no doubt on my mind that any ray, from the invisible ultra-red to the invisible ultra-violet, will produce repulsion in a vacuum. The following is an experiment tried with the electric light. The spectrum was formed with a complete quartz train, no glass whatever being in the path of the rays. The purity of the spectrum was evidenced by the fact of the lines being sharp when thallium, sodium, or lithium was put between the carbon poles. The spectrum was so arranged that any desired ray could be thrown on to a lampblacked pith surface, screens being interposed to cut off the action when desired. The torsion balance was similar to the one used in the last-named series of experiments (104), but was not quite so sensitive.

The extreme red rays were first brought into position. On removing the screen the luminous index moved 9 divisions on the scale. The screen being replaced, the index returned to zero. A solution of iodine in disulphide of carbon was now interposed, and the screen again removed. The repulsion was almost as strong as before, showing that this liquid was transparent to the ultra-red rays.

The iodine solution was then replaced by a clear plate of alum 5 millims. thick, and the screen removed; a very slight movement only took place. The iodine solution was then put in front of the alum plate, so as to subject the extreme red rays to a double process of sifting. No trace of action could be detected.

Whilst this double screen was in front of the pith disk, the spectrum was gradually passed along, so as to bring the rays, one after the other, into position. No effect, however, was produced, showing that alum and iodine solution practically obliterate the whole of the spectrum.

The alum plate and iodine cell were now removed, and the green of the spectrum (the thallium line) was brought into position. The luminous index moved 6 divisions. The plate of alum cut off only a small amount of this action, but the iodine cell brought the index to zero. This is a proof that the action in this case was not due to the heat-rays of the spectrum, for these are practically transmitted by iodine, and cut off by alum.

The indigo-rays were next brought into position. The spot of light moved 3 divisions on the graduated scale. Alum cut off only a very little of the action; but the iodine cell was completely opaque to the rays, and brought the index to zero.

Finally, the invisible ultra-violet rays of the spectrum were brought into position. The train being of quartz these were abundant. Care was taken to keep any of the luminous rays away from the pith disk. I think I succeeded in this; but it was not easy, owing to the fluorescence of the card and other surfaces on which stray rays fell. The spot of light moved 2 divisions, which were increased to 5 when the invisible rays were further concentrated by a quartz lens. The interposition of the iodine cell cut off the whole of the action. The alum plate cut off about half of the action, but scarcely more than would have been cut off had a piece of colourless glass of the same thickness been interposed, and it must be remembered that the alum plate has glass and Canada balsam on each side.

111. A similar experiment with the solar spectrum gave the following deflections, glass prisms being used:—

	°
Ultra-red	2
Extreme red	6
Orange	5
Green	4·5
Indigo	3·5
Ultra-violet	2

Although I give the number of divisions shown by the luminous index, I attach little importance to them as quantitative measurements. They are only single observations, and were taken before I had succeeded in getting anything like the same sensitiveness I can now attain in the apparatus. As illustrations of the fact, however, that the more refrangible rays of the spectrum act as well as the lower rays, they may be taken as trustworthy.*

112. In my former paper on this subject I have already mentioned in detail that at a certain point of rarefaction there is neither attraction nor repulsion when radiation falls on the movable index (30, 43, 47, 66). I have long tried to ascertain the law governing the position of this neutral point. My results are not yet ready for publication; but they are shaping themselves in order, and will, I trust, lead to a true explanation of the cause of these phenomena.

The barometric position of the neutral point dividing attraction from repulsion varies according to circumstances; among these may be mentioned the density of the substance on which radiation falls, the ratio of its mass to its surface, its radiating- and conducting-power for heat, the physical condition of its surface, the kind of gas filling the apparatus, the intensity of radiation, and the temperature of the surrounding atmosphere.

When the surface exposed to radiation is pith, the neutral point is somewhat low. I have had it vary between 50 millims. and 7 millims. (30) below a vacuum. It is, however, impossible to ascertain exactly; for a point of rarefaction can be obtained at which the warm fingers repel, and incandescent platinum attracts. With a heavy metal in the form of a sphere, so as to expose the smallest surface in proportion to the mass, I have not attained the neutral point until the exhaustion was within a very small fraction of a millimetre (43, 47); whilst if the metal is in the form of thin foil the neutral point may easily be got lower than with pith.

I am inclined to believe that the true action of radiation is repulsion at any pressure, and that the attraction observed when the rarefaction is below the neutral point is caused by some modifying circumstance connected with the surrounding gas, not necessarily of the nature of air-currents (80). As a proof of this I have not unfrequently obtained repulsion from radiation when the apparatus was full of air at the normal pressure.

113. The following experiments are too few in number, and have not been varied sufficiently as to conditions, to enable many inferences to be drawn from them. However, they afford glimpses of a law governing the position of the neutral point.

A torsion-apparatus was fitted up similar to the one

* A Paper communicated to the Royal Society, March 20, 1875. From the *Philosophical Transactions of the Royal Society of London*, vol clxv., pt. 2.

* Everything is ready to try a series of experiments with the solar spectrum, as soon as sunshine is available. The results shall be communicated in a subsequent paper.

described in paragraph 102. The beam was of glass, and at one extremity was fitted with a spring clip, also of glass, so that different bodies could be experimented with. Disks of platinum foil, 1 centimetre in diameter and weighing 1·28 grs. each, were prepared, and they were fixed in the clip at the end of the torsion beam, either singly or two, three, or four together, in such a manner that while the disk exposed was always 1 centim. in diameter, the weights should be in the proportion 1, 2, 3, 4. At the other end of the beam a movable counterpoise was arranged, so that the length of beam from the platinum disk to the centre was always the same.

The neutral points were as follows:—

No. of Disks.	Barometer.	Gauge.	Diff. = Neutral point.	Differences.
1.	760	682	78	
				8
2.	760	690	70	
				16
	760	706	54	
				24
	760	730	30	

114. Two pieces of platinum, *a* and *b*, were now cut from the same sheet, each having 1 square centim. of surface. *a* was left the full size, but *b* was carefully folded in four, so as to expose a surface of only a $\frac{1}{4}$ of a square centimetre, the weight remaining the same. The neutral points were then taken. The average of several observations (which, however, were not quite so concordant as could have been wished) were, below a vacuum,

a.	*b*.
136 millims.	70 millims.

The pieces of foil were then coated with lampblack, and observations again taken. This time the neutral points came out—

a.	*b*.
66 millims.	124 millims.

An intimate connection is thus shown to exist between the absorbing (and radiating) power of the surface on which radiation falls and the atmospheric tension at which the movement is reduced to a minimum. Further experiments on this subject are in progress.

(To be continued.)

NOTE ON ATACAMITE.

By T. C. CLOUD, A.R.S.M.

This mineral is found in large quantities in this district, and some mines have produced magnificent specimens. In many cases it is evident that this mineral has been formed from the oxide most probably by the action of salt water. I have specimens in my possession consisting of a central portion of massive cuprite with crystals of the same, the whole being converted to a depth of about 0·1 inch into atacamite.

When this mineral occurs in contact with limestone rock near the surface of the country it is invariably converted more or less into green carbonate of copper; in some cases this change has only extended to a slight depth, while in others the whole mass is thus converted.

The following are the results of an analysis of a well crystallised specimen of atacamite from this district (Yorke's Peninsula).

Copper	13·73
Chlorine	15·38
Protoxide	55·91
Insoluble residue	1·47
Water, by difference	13·51
	100·00

The crystals selected for the analysis were about $\frac{1}{4}$ inch long, of a clear dark green colour, and perfectly transparent.

It was desired to ascertain the combined action of heat and air on oxychloride of copper. For this purpose a portion of the substance employed in the above analysis was placed in the centre of a combustion tube between two plugs of asbestos; air from a gas holder was passed slowly through the tube, while the latter was heated gradually up to the highest temperature obtainable with a charcoal combustion furnace. This temperature was maintained until the sublimate did not appear to increase further in quantity. When cold the contents of the tube were examined. At the cooler part of the tube a sublimate had formed varying in colour from light yellow to dark brown. On examination this proved to be subchloride of copper. In the place of the original substance there remained a brilliant black fritted mass of protoxide of copper. The internal portion of the tube extending for a short distance from the point where the original substance was placed, towards that part of the tube where the sublimate had formed, was converted into a bluish green glass. At the commencement of the experiment, when the temperature was comparatively very low, oxygen was evolved. I do not know whether this reaction has been noted before, but it is readily observed on heating a small portion of atacamite in a test-tube.

The experiment detailed above was repeated, the atacamite powder in this case being placed in a platinum boat, all the other conditions remaining the same; the results were identical with those obtained in the former experiment. The reaction which takes place when oxychloride of copper is heated with access of air would therefore appear to be as follows:—

$$CuCl_2 + 3CuO + 4H_2O = Cu_2Cl_2 + 2CuO + O + 4H_2O.$$

Laboratory, Wallaroo Smelting Works,
Wallaroo, South Australia,
October 5, 1876.

BUTTER ANALYSIS.
AN IMPROVED METHOD OF ASCERTAINING THE SPECIFIC GRAVITIES OF FATS.

By C. ESTCOURT, F.C.S.

Analyst to the City of Manchester, Borough of Oldham, &c.

The great advance which has been made in food analysis since the passing of the "Food Adulteration Act of 1872" is nowhere so apparent as in the methods employed to detect adulterations in butter. It is scarcely three years since the time when the only methods of butter analysis, so-called, consisted entirely of smelling and tasting. Thus we had a butter taste, a tallow taste, and a lard taste. The first advance made was the observations of the fusing-points of different fats, and the next one was the estimation of the fatty acids present in fats of various origin. The last named process has, since its discovery by Messrs. Angell and Hehner, been so elaborated by various workers, amongst whom are Drs. Dupré and Muter, that nothing further in this direction can be expected.

The process, however, which recommends itself by its simplicity, and its good results, if properly carried out, is that of taking the specific gravities of various fats, butter fat amongst others. This process, devised by Mr. James Bell, F.C.S., principal of the Inland Revenue Laboratory, has only been slightly modified since its first application. The modifications were the change of temperature in the water used to compare with the fat, and the use of specific gravity beads.

In ascertaining the presence of, and estimating the quantity of foreign fat in butter by either the fatty acid, or the ordinary specific gravity method, several difficulties present themselves. In the first

method the possible loss in manipulation, and the tedious nature of the process (shortened as it has been) are strong objections. In the second method no objection can be made as to the time occupied, but a serious consideration is the extreme care necessary in taking gravities at so high a temperature as 100° F. by means of a specific gravity bottle. Those who have tried a large number of these determinations will see how difficult it is to be certain that the gravity bottle is filled with the fat and cleared of all outside deposits exactly at 100 F. A degree, more or less, is quite equal to 0·5 in the gravity, and this difference will certainly occur where two operators are examining the same sample, and sometimes in two experiments by the same operator.

Having tried all these methods with fair success I was led, by the considerations I have stated, to try whether the specific gravity of fats could be taken by means of a specific gravity balance, working by immersion, the tube containing the fats being kept at a constant temperature. Naturally my first idea was the water or steam bath, and I may say at once that no objection can be taken to it on the ground of high temperature, as the first step in all processes for butter analysis is to heat it on the bath until the curd and water deposit.

I found, however, that the steam constantly deposited on the beam of the balance, and thus affected the results. I therefore devised a method free from this inconvenience, and which I have found to give exceedingly constant results.

The balance I use is one made by G. Westphal, of Celle, Hanover, and works very accurately. The bulb of this balance is suspended in the test-tube ($1\frac{1}{2}$ in. by 5) which contains the fat. This test-tube is immersed in a metal tube containing paraffin (any other substance with high boiling-point will do), which is closed at the bottom. This tube is fastened securely by luting, &c., on to the lid of a small water-bath of suitable size, which has an outlet for steam, to which a glass tube can be attached, and a tube at the side to indicate the quantity of water in the bath.

The *modus operandi* is as follows:—The water-bath is fitted up to the proper height, which should be always the same. The metal tube is filled with paraffin, and when (heat having been applied) the paraffin is melted a thermometer is placed on it and the test-tube of fat. When the fat is melted the balance is adjusted, the bulb is immersed in the fat, and the weights (approximate) are placed on the beam. When the temperature of the paraffin indicates 206° F. I exactly adjust the weights, and then when it becomes stationary for a minute, which it does in my bath at 208° F., I put the exact weights on, allow it to remain in equilibrium for five minutes, then record the weight, which is the specific gravity of the fat under examination.

I give below the results of a series of experiments with this apparatus.

No.	Description of Fat.	Temperature of Paraffin Bath 206° F. Specific Gravities.	
		Found.	Calculated.
1.	Beef fat	860·0	—
2.	Mutton fat	860·6	—
3.	Lard home rendered.. ..	862·8	—
4.	Butter M.	870·0	—
5.	Butter BB...	870·7	—
6.	Equal weights of Mutton No. 2 and butter BB. ..	865·6	865·0
7.	Equal weights of beef No. 1 and butter M..	865·7	865·8
8.	Equal weights of lard No. 3 and butter M..	865·8	866·4
9.	Dutch butterine..	865·2	—

In performing the above experiments I have alternately heated and cooled the fats and found the specific gravities fairly constant. It is not the least recommendation of this method that a dozen observers will (unlike in the fatty acid and the gravity bottle method) arrive at the same results. It will be observed that the ordinary way of calculating the amount of foreign fats is rather in favour of the vendor of the adulterated article, as equal weights of fats mixed do not produce exactly average gravities, as at first sight might have been supposed. In conclusion I may point out that each observer should test his balance and apparatus with the various fats, as the stationary temperature of his own apparatus may slightly vary from 208 F.

NEW METHOD OF SEPARATING NICKEL AND COBALT.

By ANTHONY GUYARD (HUGO TAMM).

THE alkaline sulphocyanides exert an unequal action on the sulphides of nickel and of cobalt recently precipitated. In the cold we do not observe a very marked action, but on raising the temperature we see the sulphide of nickel enter into solution with a very great facility, whilst the sulphide of cobalt resists more, and only dissolves even in a considerable excess of sulphocyanide, after prolonged boiling. This reaction is not sufficiently distinct for analytical application, but by a modification we render it practical, and find ourselves in possession of a very elegant and very exact method of separating nickel from cobalt. In fact, in *cold* and *very dilute* liquids, the sulphide of nickel recently precipitated is dissolved with a surprising rapidity in *cyanide of potassium*, whilst sulphide of cobalt is perfectly insoluble. In these conditions the reaction is so clear and distinct that we may find in the oxide of nickel traces of cobalt (which we could only detect by the aid of the blowpipe), and effect their separation.

In the course of an analysis the best way of proceeding is as follows:—We separate, in the usual manner, the cobalt and nickel from the metals which accompany them; then we precipitate both by a slight excess of sulphide of ammonium. We dilute the liquid with a suitable quantity of water; then add gradually a weak solution of cyanide of potassium, avoiding excess. This operation is rendered easy by the fact that the mass of sulphides clears up, and the sulphide of cobalt floats in particles detached from each other, and we distinctly see what passes in the liquid. We then filter, collect the sulphide of cobalt, and determine the cobalt in the ordinary way. To isolate the nickel we acidulate the filtered liquid with a slight excess of muriatic or sulphuric acid. The nickel is precipitated in the state of cyanide, and that so completely that we cannot find traces of it in the liquid. This cyanide is collected upon a filter, well washed, then calcined. Oxide of nickel is thus obtained so pure, in some cases, that it may be weighed and determined at once as nickel. However, in general, it is prudent to purify this oxide, which often retains silica: in this case we proceed in the ordinary manner.

The advantage of the process which I propose for the separation of nickel and cobalt is that it permits us to determine the nickel without having to manipulate it in the state of sulphide—an operation always long, very delicate, and very troublesome.

Under favourable circumstances the analytic process that I have just explained will certainly be one of the most simple processes, and may be applied to the separation of nickel and cobalt on a large scale.—*Bulletin de la Société Chimique de Paris.*

Project of a Great Aquarium.—At the Exhibition to be held at Paris, in 1878, M. Toselli proposes to construct a great aquarium to serve for the display of diving-bells, instruments for raising sunken ships and their cargoes, &c.—*Les Mondes.*

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, December 7th, 1876.

Dr. J. H. GLADSTONE, F.R.S., Vice-President, in the Chair.

AFTER the names of the visitors had been announced, and the minutes of the previous meeting read and confirmed, the following names were read for the first time:—Messrs. W. Hampton, J. Napier, D. W. Ladley, J. C. Leach, and W. H. Ellis. Messrs. Walter Charles Davis, John Clark, Frank Herbert Marshall, John Wood, Griffith Jones, B.A., John Falconer King, and Charles Cecil Capel were elected Fellows of the Society by ballot, after their names had been read for the third time.

The first communication was by Prof. A. H. CHURCH, "*On Colein*." This, the red colouring matter existing in the stems and leaves of the *Coleus Verschafellii*, was prepared from the bruised stems by exhausting them with cold alcohol, slightly acidulated with sulphuric acid, removing the acid by barium carbonate, and concentrating by distillation. The various processes were tried for the purification of the red colouring matter, the best being to dissolve it in alcohol, precipitate with ether, again dissolve in alcohol, and pour the solution into water, repeatedly washing the precipitate with water at 50° to 60° C. On analysis it gave numbers corresponding with the formula $C_{10}H_{10}O_5$: this was confirmed by the results obtained from the lead compound, $C_{20}H_{18}PbO_{10}$. The latter was prepared by precipitating the colein with excess of lead acetate, both in alcoholic solution. It is of a dull indigo-blue colour. Colein is insoluble in ether, only slightly soluble in water, but readily in alcohol, yielding a solution, which is at first crimson, but fades rapidly, owing to a combination taking place between the alcohol and the colouring matter. On evaporating the nearly colourless solution, or on adding an acid, the crimson colour is, however, restored. By gradually adding ammonia to a solution of colein, the colour is changed successively to purple, violet, indigo, chrome green, and finally to greyish yellow. Stannic chloride gives a precipitate of a beautiful violet colour when added to a strong alcoholic solution of colein. The author also described and exhibited the spectra of colein, both in a pure state, and also when submitted to the action of various reagents.

The CHAIRMAN having thanked Prof. Church for his interesting paper,

A MEMBER said that when working with ivy he had extracted a colouring matter from the pericarp of the fruit, which appeared to be analogous, if not identical, with the colein of Prof. Church. Its colour was intensified by the addition of acids, whilst alkalies, on the contrary, changed it.

Mr. GROSJEAN, in reference to the author's remark as to the close resemblance between the colouring matter of the grape and colein, stated that when determining the value of red argols he had noticed that the colouring matter present gave a very sharp reaction with alkalies, almost as distinct in fact as litmus. In this case, however, the yellowish tint produced by a slight excess of soda was again changed to red on the addition of an acid, whilst colein appears to be decomposed, as the colour, when once changed by an alkali, does not come back.

Dr. OTTO WITT made a short verbal communication "*On Phenylen-Diamin*." This was prepared by the action of reducing agents on dinitrobenzene, and is employed in the manufacture of the brown dye known as "Vesuvine." It may be obtained from the solution as a crystalline hydrochloride, after the removal of the lime by oxalic acid. On distilling the hydrochloride with lime, the phenylen-diamin passes over. It is a colourless crystalline substance, which, however, rapidly becomes dark coloured on exposure to the air. The author has obtained the diacetyl compound, and also several brominated derivatives of the latter. He hoped soon to lay before the Society a detailed account of the manner of preparation and the properties of these compounds.

Dr. GLADSTONE having thanked the author in the name of the Fellows,

The SECRETARY read a paper by Mr. J. B. HANNAY, "*On Calcium Sulphate*." The paper contains a description of various double and triple salts containing $CaSO_4$, which were deposited in the interior of pipes in a manufactory. Solutions circulated through these pipes containing simultaneously K_2SO_4, Na_2SO_4, $CaSO_4$, $MgSO_4$, and K_2CrO_4, the last being in by far the largest proportion. The temperature of the liquids varied from 40° to 80° C. In one instance most of the incrustation consisted of $CaK_2(SO_4)_2+H_2O$, but there were also present two other compounds, $CaSO_4.K_2CrO_4+H_2O$ and $CaSO_4.2K_2CrO_4$. They were both of a bright golden colour, resembling lead iodide, and very similar in appearance. By the action of water they are decomposed, the potassium chromate dissolving out, and leaving calcium sulphate, but without any change in the form of the crystal. In another pipe, where there were large quantities of the salt $CaNa_2(SO_4)_2$, a salt having the formula $CaSO_4,Na_2SO_4,K_2CrO_4+H_2O$, or some multiple of this, was found. The author has also made several experiments to ascertain if the following series of compounds existed:—

$2CaSO_4+4H_2O$.
$2CaSO_4+3H_2O$.
$2CaSO_4+2H_2O$.
$2CaSO_4+H_2O$.

The first of these is deposited when a solution of calcium sulphate is evaporated at 100° C. under the ordinary pressure, and the last by evaporation under a pressure of 90 pounds to the square inch. No definite results could be obtained at intermediate pressures. On heating $CaSO_4+4H_2O$ (pure selenite) to 118° it begins to lose water, at 150° the loss indicated the formation of $2CaSO_4+H_2O$. At 190° the last molecule of water is driven off. By heating the selenite first at 118° to start the dissociation, and then at 100° for a long time, indications were obtained of the existence of $2CaSO_4+3H_2O$, but none of the compound $2CaSO_4+2H_2O$.

Dr. H. E. ARMSTRONG said he had made some experiments with a view to ascertain if there was any relation between the loss of water experienced by certain isomorphous salts under precisely similar circumstances. He had found that at the ordinary temperature over sulphuric acid the sulphates of zinc, magnesium, nickel, and iron parted with their water of crystallisation in ratios represented by the numbers Zn, 7460; Mg, 2685; Ni, 1575; and Fe, 4015. With potash and chrome alums the ratios were—K 0865, and C 4625; the nitrates of cobalt, nickel, and manganese gave—Co, 272; Ni, 032; and Mn, 210.

The CHAIRMAN having thanked the author for his paper, and Dr. Armstrong for his interesting observations,

Mr. G. S. JOHNSON read some "*Additional Notes on Potassium Tri-iodide*," consisting of a corrected determination of the specific gravity of the crystals, which was found to be 3·498, and the atomic volume, which is 120·2. The theoretical number, calculated on the supposition that an atom of potassium unites with three of iodine *without* condensation, is 122·2.

The meeting was then adjourned until Thursday, December 21, when Mr. W. N. Hartley will give a paper entitled "A Further Study of Fluid Cavities."

NEWCASTLE-UPON-TYNE CHEMICAL SOCIETY.

General Meeting, October 26th, 1876.

The PRESIDENT in the Chair.

THE minutes of the last meeting were read and confirmed.

The following Report of the Committee was read:—

In commencing the ninth session of the Society the Committee find that there is but little on which they need specially remark.

The number of members remains about the same, in spite of additions to the list of new names, these being about balanced by withdrawals and removals from the district. The Committee would here observe that considerable trouble is caused by gentlemen who, without giving any formal notice of withdrawal, neglect to pay their subscriptions, and take no notice of the applications of the Treasurer. As every member, so long as his name remains on the list, causes to the Society a certain amount of trouble and expense, the Committee feel that it would be only fair on the part of those members to signify to the Secretaries their desire to withdraw.

The deficit, irrespective of arrears of subscriptions, has increased during the last twelve months, and the Committee will probably have to consider two alternatives—a less extended report of the discussions upon papers, or an abandonment of the refreshments which have been for some sessions provided at ordinary meetings; unless, indeed, some source of increased revenue can be suggested, *e.g.*, an increased list of members.

The Committee are, of course, hardly in a position at present to express a decided opinion on this very important point, but they hope to bring it before an early general meeting.

In conclusion, the Committee appeal to all members to assist them in their efforts to render the ensuing session a successful one, by personal co-operation. It will be seen, by referring to the *Transactions*, that the bulk of the labour in this respect has been borne by members whose names recur but too frequently, and the Committee would earnestly impress the desirability of a change in this respect.

Mr. N. H. Martin was unanimously elected a member.

The following names were read for the first time:—John Henry Payne, Jarrow; William Crake, Newcastle; H. E. Scholefield, Newcastle.

President's Address.

Gentlemen,—Before commencing the Address, the delivery of which custom imposes upon me, permit me to thank you very sincerely for the honour you have done me in electing me as your President—an honour which I appreciate none the less that I could most sincerely have wished it had fallen upon some other member of the Society. One of the principal difficulties which a President must experience on such an occasion lies in the selection of topics; not but that in the range of our science there is an abundance on which to speak, to more or less profitable purpose, but the difficulty is really to select amongst the mass of materials which present themselves at the very outset. We enter to-night upon our ninth session. I may assume then, I think, that our *raison d'être* is abundantly demonstrated, and it is hardly necessary that I should occupy your time in considering what are the functions of a Society like our own, and how far we discharge them. When we turn to the other alternative, a more or less systematic review of the progress of our science during the last twelve months, we experience at once the difficulty of selection. The *Journal of the Chemical Society*, as most of you know, is made up almost entirely of abstracts, condensed of necessity into the very smallest space; and yet, during the six months ending last June, it occupied no less than 998 closely-printed pages. We may, however, select from among the varied subjects which have occupied our little world during the last twelve months some sufficiently prominent to afford materials for a few minutes consideration.

We have no particularly sensational—if I may permit myself the term—discovery to record. The nearest approach to that, perhaps, is the further examination by M. de Boisbaudran of his new metal Gallium; and here I may remind you of the reclamation made by M. Mendeleef in connection with this subject, and with the theory which he promulgated more than seven years ago, that "the physical characters of a radicle are periodic functions of its atomic weight." Having pointed that out, he proceeds to remind us that the characteristics which are assigned to gallium are precisely those which he assigned seven years ago to the metal which he then designated "Ekaluminum," and which he argued, on purely mathematical grounds, ought to exist. Now, whether this is merely a more or less interesting coincidence, or whether it is really the climax of a process of pure mathematical reasoning, by which we shall be able to predicate radicles which *ought* to exist, we can hardly yet say. When "Ekasilicium," of which he has also predicted upon purely mathematical grounds the existence, is discovered, and discovered existing, as he says it will exist, in company with arsenic, we shall then, I think, have a rather wider basis for induction. Still we must admit that the coincidence, if a coincidence it be, is a very interesting one, and one well worthy of being recorded. Passing from this to a closely-allied subject, I may remind you of the interesting paper, produced in the course of last year by Prof. Henry Wurtz, on, as he entitles it, "A New System of Geometrical Chemistry." If you have read that paper I am sure you will agree with me that the greatest credit is due to him for the untiring labour which must have gone to the collecting of the data for his system. Every specific gravity which has ever been published on reliable authority for any compound appears to have been collated by him; and in a not less notable manner is his ingenuity displayed in putting together these data, and in inducing eventually three laws, which I should certainly advise you to read for yourselves.

Passing from the applications of the purer and higher—for I suppose we must say the higher—science of mathematics to our experimental data, we come to one or two subjects upon which purely experimental data, and data of very considerable value, have been afforded to us during the past year. Mr. Thomas has produced two papers—or I should rather more correctly say three—of the very highest interest, on the "Gases Occluded by Coal." I will not detain you by going into details which you can read for yourselves in the *Journal of the Chemical Society*, but I cannot help remarking that they are of exceeding interest, as additions to our knowledge on the subject, of which we knew little or nothing previously, with the exception of the somewhat imperfect researches of Von Meyer,—researches imperfect, not because there had not been every care bestowed upon them, but imperfect, as I cannot but think, from the method employed in carrying them out. I may remind you of his process for collecting these occluded gases, consisting in heating a flask filled, partly with the coal under examination, partly with recently boiled water, and collecting the gases evolved also over water. I need scarcely point out to anyone who has even a limited experience of gas analysis the imperfections of this method, in regard both to evolution and collection of the gases. The more perfect method employed by Mr. Thomas, of heating in a vacuum produced by the use of a Sprengel pump, has yielded results very different from those of Von Meyer, and which, when the series of researches is completed, cannot but be of the greatest value to all who are concerned with the technical as well as theoretical consideration of the subject.

Mr. Galloway has dealt with a kindred subject—"The Effect of Coal-Dust upon the Productions of Explosions in Coal-Mines." Many of us, I believe, were present at the exceedingly interesting demonstrations which Mr. Galloway gave, some two or three years ago, in this room, in connection with his former research upon the effect of a sound-wave on the passage of flame. This latter subject, which Mr. Galloway has investigated, is equally closely connected with the well-being of coal-pits, and I may therefore state briefly the results at which he has arrived. It might have been very well doubted—and it is, in fact, even now to a certain extent doubtful—how far dry coal-

dust *per se* is capable of producing, when unmixed with fire-damp, a mixture with air which can be termed explosive in the ordinary sense of the term. Experiments are in progress with the view of determining this point, and it is not impossible we may be able to lay some of the results before our Society during the present session. But what Mr. Galloway has shown us is, that where, in addition to coal-dust, there is present a very small proportion of damp, which can hardly show itself by a cap on the miners' safety lamp, that very small quantity is equal to the formation of an explosive mixture. A quantity, ranging from 1 to 2 per cent of fire-damp, when mixed thoroughly with the air of the mine and coal-dust, and passing over a naked light, is capable of producing an explosion, or, on a small scale, an exceedingly rapid combustion. Clearly these experiments bear upon the everyday work of our own district, and, as such, we are indebted to Mr. Galloway for his painstaking investigation of an exceedingly important question.

I come now to a set of experiments which possibly many of you have already read in detail, and which partake alike of the purely scientific and of the practically interesting character. I allude to the researches which Dr. Tyndall has conducted, after his well-known patient method of experiment, on the relation of the optical deportment of the atmosphere to the phenomena of putrefaction and fermentation. It is so obviously impossible to give more than the very briefest abbreviation of these results that I must refer you for details to the paper in the *Transactions of the Royal Society*; but the cardinal experiment, of which all the others are variations, and upon which the proof of Prof. Tyndall's proposition mainly rests, I think I shall be able to explain in a very few minutes, with the assistance of the working model on the table. I need not remind you, I suppose, of the former researches of Prof. Tyndall in this same direction. I need not point out to you how he has shown that the purity or otherwise, as regards suspended matter, of the atmosphere can be determined rapidly, easily, and certainly, with the assistance of a sufficiently powerful beam of light. I need not remind you of the "motes in the sunbeam," which Prof. Tyndall has happily adopted as the term to designate the somewhat indefinite suspended matter of the atmosphere, but I may just illustrate by experiment his beautiful demonstration of the probability of the organic character of—at any rate by far the larger portion of—that suspended matter. If we turn on this lime-light, and bring below its track, marked out in the air of the darkened room, a Bunsen burner, you see the appearance of smoke produced by the heated air traversing the light track, and destroying the suspended matter. Now, extending the application of this process, Prof. Tyndall has constructed an apparatus, of which we have a rough working model before us on the table. We have a box which can be closed practically dust-tight. We have the means of transmitting a powerful beam, such as we have just been using, from side to side of the box, and so observing whether there is any difference in optical deportment of the air inside the box and the air outside it. We have, of course, in front the means of observing this; and we have a small door fastened dust-tight, by which we can keep the box in communication with the external atmosphere, or not, at will. Lastly, we have an aperture above through which we can pass the point of a pipette. We varnish the sides, top, and bottom of the box with a mixture of glycerin and water, to act as a mote trap and detain the suspended matter which settles upon it. Then, closing the different apertures of the box, we leave it to itself for a few days, and from time to time examine it with the help of such a beam (or a stronger one), as you have just seen. After a time the whole of the motes in the little portion of included air have settled on the sides and bottom of the box. The track of the beam of light can no longer be distinguished inside the box, although we can see it easily before it enters and after it emerges; and now our air is optically pure, and in a condition to commence experimenting with. Then, passing through the pin-hole the pipette, we fill by its means the test-tubes which you see are cemented into the bottom of the box with an infusion of any animal or vegetable matter you choose. We abandon these, after heating them to rather above boiling-point by a salt-bath below, to their own devices. Now, Dr. Tyndall has repeated this experiment with some 600 different test-tubes containing every variety of infusion, and he has found that when the tubes have been heated to boiling in contact with the mote-free air, and then abandoned to themselves, they have never in any one case undergone the action which we style putrefaction, and after they have remained for some time unputrefied the mere opening of the box is sufficient in two or three days, by the action of the motes in the air from outside, to initiate with unerring certainty the phenomenon of putrefaction. I cannot see how we can logically come to any other conclusion than that this phenomenon, and, probably, its close ally fermentation, depend upon the action of what Prof. Tyndall calls motes. Others perhaps would give to them the name of germs, but if we call them motes we commit ourselves to nothing except that the suspended matter of the atmosphere is closely connected with these phenomena. I should weary you if I were to go into detail on the different forms in which this experiment has been repeated. You will find them described at length in the original paper, and the more you read the more I think you will be possessed with a sense of their beauty. But there is one part of the experiments which is so exceedingly interesting, both theoretically and practically, that I must attempt its description. Let another set of tubes be connected with the sides of this box; let them be filled with a putrescible fluid; let that undergo the action of putrefaction; and when that action is at its highest, and when the gases evolved during it have completely filled the box, let the lower tubes be also filled with a putrescible fluid, by means of the pipette. Let that be boiled and abandoned to the action of the gases evolved during putrefaction, and in no case will it undergo putrefaction. It may be in the fullest contact with the most nauseous gases from putrefaction, but as long as only gases are brought into contact with it, it will not putrefy; but let the smallest fraction of matter already putrefying be introduced into the "protected" fluid, as we may term it, and putrefaction is absolutely certain. I should probably spend too much time if I were to go into details as to the practical bearings of this experiment, but I think you will see the analogy which Prof. Tyndall points out between this and the not unfrequent case of sewer gas causing zymotic disease is not a far-strained analogy after all. When we endeavour to trace a connection between sewer gas and zymotic disease we are constantly met with this objection—"If it is really the dreadful thing it is said to be, why is there not disease in every house in which it may be smelt?" Not to dwell on the probable necessity for a favourable *nidus* as well as for the germ, in order to initiate that class of disease, I may point out that here the sewer gas, instead of being actually the cause of disease, simply tells us, by its unmistakable smell, that communication is established between the drain and the house,—it may be to bring in only comparatively innoxious gas, but it may be to bring in a current of gas laden with zymotic poison, which we may liken to the motes in this box. And the more you consider this case the more you will see the close bearing this experiment of Prof. Tyndall's has upon a matter which concerns our public health in the closest degree.

I should not leave this subject, or, if I did, I should leave it exceedingly incomplete, if I did not refer to Dr. Frankland's elaborate paper on the examination of potable waters. I will not detain you by enlarging upon the vexed question of water analysis, but there one or two points in the paper which are of sufficient interest to be worth remarking on. Probably many of you have read all that is there said of the case reported from Switzerland, of the conveyance of typhoid fever for very nearly a mile in dis-

tance through a water-supply. The two experiments cited are so interesting and so ingenious, and lead to such exceedingly important practical results, that I may go into them a little in detail. In the first instance, to establish the fact that the source of the water-supply from which the contagion was supposed to have been derived in the first instance was really in connection with the public wells, which were supposed to have conveyed the disease, the following experiment was made:—Some hundredweights of common salt were put into the suspected water-supply, and in the course of a comparatively short time the quantity rose in the *well water* to sixteen or eighteen times the normal amount. I do not think we need any further proof that the two sources of water-supply were in complete connection; but to supplement that experiment, and to trace the effect of the filtration of the water through a very considerable length of porous soil, a few hundredweights of flour, sufficient to make the water thoroughly turbid, were thrown in and stirred into the suspected source. Although the salt had traversed the connecting strata not a trace of the flour could be detected, either by chemical or microscopic examination in the contaminated well water. Mechanical filtration then had been quite sufficient to remove this suspended matter, but had, nevertheless, been insufficient to remove the subtle typhoid infection. Now, that that proves positively that infection is due to a "germ," I do not say: it will be evident that the phenomenon is equally easily explicable, whether we suppose it to be due to an infinitesimal germ, so minute as to pass the filtering-bed in such way as an infinitesimal particle—say of sulphate of barium—passes a filter-paper; or whether we suppose it to be due to a definite soluble poison existing in solution; and therefore capable of passing any filter, no matter how effective. On either ground the results seem equally explicable; but they point clearly to one fact—that no process of mechanical filtration, however complete, can really be trusted to purify water which has once received the infection of the diseases which we group together for convenience under the name of zymotic.

(To be continued.)

NOTICES OF BOOKS.

Science in Sport made Philosophy in Earnest, being an Attempt to Illustrate some Elementary Principles of Physical Knowledge by means of Toys and Pastimes. Edited by Robert Routledge, B.Sc., F.C.S. London: G. Routledge and Sons.

The author of this work tells us that his original design was merely to produce a new edition of a work written some half century ago, by a Dr. J. A. Paris, under the title "Philosophy in Sport made Science in Earnest." He found it necessary, however, to re-write and extend the whole of the scientific matter in the book in order to bring it into harmony with the existing state of knowledge. For the story with which the instructive portion of the original work is interwoven he has found it desirable to "substitute a quite different, much slighter, less intricate, and perhaps more probable tale."

This work, therefore, is a story, or, if the reader will, a novel made the vehicle of physical instruction and interspersed with lectures, or, as they are now called, "conferences." The author expresses a hope that no one will find in the narrative in itself so much attraction as to "skip" the graver portions of the book. How far he is right in this respect, considering the truly canine appetite with which fiction is devoured by the public, may perhaps be doubtful. Were we an authority on such points we might question the *raison d'être* of Miss Ryland and her sister-gossips—characters not wholly new in literature even though they combine with their morbid love of scandal the new mania for "woman's rights." They are introduced without necessity; they neither exert any influence on the progress of the story, nor are made to illustrate any physical principle, and they soon disappear, having merely served to add a few pages to the bulk of the book. The science of the book, after a careful examination, appears to us accurate, and it is certainly illustrated with no small felicity. Exception may, however, be taken to certain remarks on colours in the sixth chapter. Thus the author asserts that "the supposed effect of scarlet (dazzling the eye) is explicable by its comparative rarity in nature, and I doubt not but that if all the green and red changed places we should be as much attracted by green as we now are by red, and would attribute to it the same exciting effect; while the repose you speak of as belonging to green would seem to belong to the scarlet foliage to which our eyes would be so much accustomed."

We are at a loss to conjecture upon what facts this singular opinion can be based. Scarlet is, indeed, somewhat rare in nature, but in dye works it is as plentiful as is green, and the examination of pieces of scarlet cloth to ascertain whether they are correct to shade is found very fatiguing to the eyes. If scarlet or even magenta swatches are regarded for a long time, and fixedly, the eye becomes temporarily incapable of judging of their exact tone. The observed effects of light of different colours upon vegetable life clash also with Mr. Routledge's view.

The fifteenth chapter, in which the author treats of work and its measurement of energy, and explains the meaning of the foot-pound, may be advantageously read, not merely by children, but by many of mature age who entertain somewhat hazy notions on this subject.

We hope this volume may meet with such a reception as to induce the author to extend his plan and produce a companion volume dealing in a similar manner with some of the many scientific questions not here included.

The Combined Note Book and Lecture Notes for the Use of Chemical Students. By Thomas Eltoft, F.C.S. London: Simpkin, Marshall, and Co. Manchester: John Heywood.

This book contains a table of the elementary bodies, with their symbols and atomic weights. Then follow remarks on elements, symbols, compounds, and chemical formulæ; on the use of brackets; on oxides, anhydrides, and acids; on the atomicity of the elements; tables of sulphides and sulphites; on the formation of chlorides and bromides, iodides, fluorides, and cyanides; on the salts of dibasic acids; on the density of gases and the "crith."

Then follow a number of leaves arranged for taking lecture notes, with certain headings to be filled up.

The last part of the book, as the author tells us, "contains all the best known methods for the preparation of the various elementary and compound substances," at least, as far as the non-metallic elements are concerned. He has "purposely left out any explanation as to the condition under which they are prepared, preferring that this should be done by the student himself, either from his lecture notes or text-books." By this method, it is said, he gains "two objects, viz., good and sound work without any cramming." Finally there is a table of tests for the most important acids.

The work, we are told, is "not in any way supposed to take the place of a text-book, but to act as an adjunct to it."

On the Present State of the Iron Manufacture in Sweden. By Rich. Akerman (School of Mines, Stockholm). London: E. and F. N. Spon.

The iron manufactures of Sweden, though long famous and still eminent as far as quality is concerned, are not carried on upon a scale of great magnitude. This is due to the want of coal, which is only found in the more southern part, and to the fact that the deposits of

iron-ore are remote from the more extensive forests and peat beds. The ores consist chiefly of magnetite and hæmatite. In some districts, such as Gräsberg, these two ores are so much mixed together that it is not easy to decide to which species samples ought to be assigned.

These ores belong to the primitive or Laurentian formation, and generally occur in stratified masses, having the same strike and dip as the surrounding rocks. They may be arranged in three classes, those rich in quartz, those abounding in magnesia, and those containing a notable amount of manganese and interspersed with sulphides. The latter class, when their proportion of sulphides is not considerable, have been highly valued for the preparation of steel. The amount of iron ranges from 30 to 70 per cent. They contain, in general, little phosphorus; those of Dannemora having only 0·003 per cent, and those of Persberg 0·05 per cent. The Grängesberg ores, however, have been known to contain even 1·5 per cent, being intermixed with apatite, whence it has been proposed to submit them to a preliminary treatment in the wet way utilising the apatite as superphosphate. Titanium, which is in some cases abundantly present, is an undesirable ingredient, as it renders the process of reduction more difficult and occasions a great waste of charcoal.

The total amount of ore raised in Sweden during the year 1874 from 696 mines was 21,692,998 centners, equal to 922,524,000 kilos. The number of persons employed was 7497. The book is illustrated with a large map of the mining districts of Southern Sweden, and contains a tabular view of the composition of Swedish iron-ores, inconveniently arranged. The continental method of using for decimals figures smaller than those denoting whole numbers has been followed, to the tribulation of the readers' eyes. The value of the work to practical men would also have been greater if the weights of metal, ore, &c., produced, exported, &c., had been calculated into tons instead of kilogrms. Apart, however, from such mere defects of form and from certain expressions, which cannot be considered idiomatic English, this publication will be highly interesting to all persons connected with the iron manufacture.

OBITUARY.

DAVID FORBES, F.R.S.

THE saddest duty of the editor of a scientific journal is that of recording the death of eminent labourers in the field of science. In the too early death of David Forbes science has been deprived of one of her most zealous and hardworking devotees, while we have also to mourn the loss of a valued friend. Few men have enjoyed greater facilities for acquiring a knowledge of nature by personal observation in different parts of the world than David Forbes, and armed with dauntless courage and indomitable perseverance he made the most of his opportunities. Those who have heard him read papers at the Chemical or Geological Societies, or who have been present when he has taken part in a discussion know how thorough and how vast was his knowledge. It is to be hoped that the manuscript notes which he had made with the view of elaborating them in future years will not be entirely lost, but that they admit of being arranged and published in some form or other, though they would have been of infinitely higher value had they received the addition of those still larger stores of knowledge which are now entirely lost. In 1858 David Forbes was elected a Fellow of the Royal Society, and at the time of his death he was senior Secretary of the Geological Society and also foreign Secretary of the Iron and Steel Institute, a post for which he was eminently fitted. His reports on the iron and steel industries are most valuable additions to technical scientific literature. Many excellent papers from his pen have appeared in the CHEMICAL NEWS; amongst them we may mention those entitled: "Application of the Blowpipe to the Quantitative Determination or Assay of Certain Metals;" "Some Points in Chemical Geology;" "The Preparation of Lime Crucibles for Great Heat;" "The Composition and Metallurgy of Some Norwegian Iron-Ores;" and "The Microscope in Geology."

He died at the age of 49, and was buried at Kensal Green Cemetry on Monday last. The Director General of the Geological Survey and the Presidents of the Chemical and Geological Societies were amongst those who were present at the grave.

The following account from the pen of Mr. F. Field, who was one of Forbes's intimate friends, renders it unnecessary for us to refer at greater length to the scientific results of his journeys and labours:—

"The death of David Forbes, a man at once chemist, geologist, and mining engineer, must have excited deep regret throughout the scientific world. Few men amongst us have travelled so much or have had the same opportunities of research. From Finland to the South of Spain in Europe, from Cape Horn to Panama in the western continent of South America, did his journeys extend, and his museum bears ample testimony to the energy and zeal with which they were prosecuted, embracing, as it does, rare and sometimes unique specimens, mostly collected by himself, of all branches of natural history from nearly every part of the globe. Only those who have travelled over the bad roads and mountainous districts of South America can appreciate the difficulty of transporting specimens from the interior of the country to the coast previously to their shipment for Europe. Perhaps a few reminiscences of David Forbes when a comparatively young man may not be altogether devoid of interest. I first met him in the Port of Coquimbo, Chile, in 1858, and was surprised at the rapidity with which he had acquired the Spanish language. He was a thorough cosmopolite, and seemed as much at home with the Chilian miners and smelters as if he had been born among them, entering into their peculiarities, accommodating himself to their mode of life, and making himself universally popular. Whilst most foreigners, Englishmen especially, on taking a journey to the various mines, require many comforts which they deem indispensable, and have, at times, almost a cavalcade of servants and mules, laden with provisions and bedding, Forbes, if the idea suddenly struck him, would take simply a single guide (and he often went quite unattended) and traversed the most distant portions of the Republic, with a rapidity and an amount of observation which were astonishing. Thus after being only a few weeks in Coquimbo, he had explored the Higuera, Tamaya, Arqueros, Andacollo, Ovalle, Tambidos, and nearly every other mineral district of importance, knowing them better than most foreigners who had resided in the country many years. I remember on one occasion he determined to make the journey from Coquimbo to Copiapó on horseback, taking with him but one servant and trusting for provisions on the way as best he might. The road is through a desert, where water is seldom obtainable, and should the horse founder far away from any habitation the consequences might be very serious. He seemed to think nothing of this or other contingencies, made the journey, and returned to Coquimbo a few weeks afterwards, fresher and better than ever. He had an iron frame, and in those days was perfectly insensible to fear. When he was staying with me some few months later, a gentleman fitted out a three-masted schooner, and purposed taking a long cruise to the Fijis and other islands in the South Pacific. Almost at a moment's notice Forbes offered to accompany him, and spent many months in that delightful part of the world. This may seem a trifling incident; it is only mentioned to show that while most of us take some time to consider, Forbes made up his mind instantly. In the Chile

Revolution of 1854, Forbes, with many other Englishmen, were my guests at the British Consulate. Although the revolutionary party were successful in the province of Coquimbo, the Government had the supremacy on the coast, and the port was strictly blockaded. The blockade was respected both by the English and French men-of-war. Forbes (I know not why) was determined to go to Bolivia. No person was allowed to leave the spot: the English steamer, on arrival, did not drop anchor, but moved slowly round the bay, depositing the mail-bag in the Chilian officers' boat. Forbes pleaded for a passage, but in vain. He was not the man, however, to be daunted by a refusal. He hired a small sailing-boat, and with only two men and a slender store of provisions left from a creek just outside the bay, by midnight, and made sail for Bolivia, leaving me the laconic lines—'Dear Field, I have broken their blockade.—D. F.' I subsequently learned from him that the winds had blown him many hundred miles beyond the port of Cobija, and he had to beat back against heavy seas for more than a week. He accomplished his purpose, but arrived, as may be supposed, half dead from fatigue and want of food.

"Although Forbes died at a comparatively early age, he had led in the half century the lives of at least three men. An intermittent fever he had contracted in Peru prostrated his strength greatly during the last few years of his life. I met him a month ago at the 'B.' Club, of which he was a member, and, although complaining of illness, he seemed to me more cheerful than he had been since his late heavy domestic affliction. I little thought when I wished him better that I had shaken hands with him for the last time.

"FREDERICK FIELD.

"Hither Green, Kent,
December 12, 1876

CORRESPONDENCE.

SULPHUROUS ACID AS A DISINFECTANT.

To the Editor of the Chemical News.

SIR,—In the CHEMICAL NEWS (vol. xxxiv., p. 245) you reprint an article from the *Lancet* "On a Mode of Generating Sulphurous Acid for Use as a Disinfectant, &c.," by Mr. Keates, in which it is stated "that there is no ready, convenient, and easily controllable way of producing this valuable agent (sulphurous acid) in use at present;" and then Mr. Keates proceeds to describe a mode of generating the acid by the combustion of carbon disulphide, as if this method were a novelty.

I have used sulphurous acid generated exclusively from the combustion of carbon disulphide as a disinfectant for rooms during a period of nearly seven years, and have in this way consumed 6 cwts. of the disulphide during the last six years. Years ago I advocated this mode of disinfection before the Society of Medical Officers of Health. I know that others besides myself have been in the habit of using it.

No special form of lamp is required. The requisite quantity of the disulphide may be placed in an ordinary porcelain or copper dish placed on a tripod, and ignited with a match. In five minutes several ounces of the liquid may be easily and safely burnt. A much larger quantity of the liquid should be used than that named by Mr. Keates—280 grs. for a room of 1300 cubic feet capacity. This would generate only 1-50th per cent by volume of sulphurous acid in the atmosphere of the room. At least five times that amount should be burnt, so as to generate an atmosphere containing 1-10th per cent of the disinfecting gas.—I am, &c.,

THOS. STEVENSON.

St. Pancras, Middlesex,
December 9, 1876.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Les Mondes, Revue Hebdomadaire des Sciences,
No. 5, October 5, 1876.

Report on Cremation, delivered to the Prefect of Police by the "Council of Hygiene and Salubrity" of the Department of the Seine.—The Commission consider that cremation would be free from all objections on the score of public health, but that its economy would be doubtful except furnaces were maintained in continual action, and that by rendering the chemical examination of the body impossible it would prevent the detection of murder by poisoning.

Note on Herbelin's Method for the Expeditious Assay of Cinchona Barks.—M. Dubois.—The author finds that this method, which consists substantially in extracting the powdered bark with benzol after previous treatment with ammonia, does not give satisfactory results. Quinine is scarcely soluble in benzol, though the two compounds have a strong mutual affinity.

Phenomena of Digestion with the Cockroach.—The digestive juices of insects are alkaline or neutral, never acid.

New Experiments with the Radiometer.—D. S. Stroumbo.—If during the night a candle is lighted before a radiometer of the same height, and placed at the distance of 20 c.m., it turns from the right to the left of an observer, placed so that the radiometer is between him and the candle. The following facts were observed:—First. Whilst the radiometer continued to turn slowly from the right to the left I placed my five fingers on the glass stem of the instrument, and kept them there: in an instant the radiometer turned in the opposite direction, *i.e.*, from the left to the right with a greater speed, and continued to turn thus indefinitely. When I removed my hand the radiometer slackened its speed, and after having turned so for some time it stopped for a few moments, and then resumed its ordinary course from right to left at a slow speed. Instead of applying five fingers I applied only one, but with the same result. I interposed silk, paper, and copper between the finger and the glass, but the same effect was produced, as also when I surrounded the glass foot of the instrument with a copper ring, which I held by a silk thread. I placed my finger on a point of the glass support very near the base at a distance of 10 to 13 c.m. from the circumference which the radiometer describes, when the same phenomenon took place, as also when I placed my finger on any point whatever, situated below the circle described by the radiometer. If I placed my finger at a point above this circle the instrument was not affected, and continued its ordinary course. If the finger is applied to the glass at a point of the circumference described by the radiometer, it stops after some oscillations, and remains at rest, but resumes its ordinary course as soon as the finger is removed. Second. The radiometer being at rest in a rather dark part of the room, I brought its glass foot in contact with a bow of copper, which I held by a strong piece of silk or cotton moistened, and which I drew horizontally. The radiometer began to turn. I let fall the bow, and the radiometer in a few moments ceased turning. I caused to be constructed a radiometer with plain discs of mica, which did not turn if placed in the sun. If it was not a radiometer, properly speaking, it was a sensitive instrument, with which the following experiments were made:—(1) I rubbed the glass surface of the instrument circularly from right to left with silk-paper; immediately the disks turned in the same direction, following the course of the paper. I rubbed in the opposite direction; immediately the disks changed their direction, still following that of the paper. The friction ceased, and the disks ceased simultaneously. The cause of this phenomenon is evident: the friction of the paper

develops electricity, which acts upon the disks by attraction in the direction of the electricity evolved. (2) This instrument being at rest, I poured upon it ether, and saw immediately the disks hover, turn slightly, and soon stop. The cause of this phenomenon is the same, the electricity produced by evaporation—a fact well known to science. (3) These facts (1 and 2) being incontestable, let us produce some analogous facts with the radiometer. (*a*) I placed the radiometer in a part of the room so dark that it did not turn. I then poured ether upon the covering, and immediately the radiometer began to turn somewhat quickly, but in a direction contrary to that which it takes when exposed to the light. After having turned thus for a few moments it stops, and resumes its former state of repose. According to the experiments 1 and 2 must not this fact be ascribed to electric action? (*b*) M. Ducretet has observed the change in the direction of the radiometer when drenched with ether; let us do the same. Whilst the radiometer is in motion, and turning from right to left, let us pour a little ether upon it; we then see the radiometer change its direction, and turn from left to right. After a few moments it stops, and finally resumes its normal course from right to left. Are we not to ascribe this change of direction to an electric action? The experiment of M. Govi, showing that the watery vapour circulating round the radiometer gives it an accelerated motion, which ceases in course of time, does it not show electricity in action? The new facts observed above (1, 2, and 3), should they not be attributed to electric action? Yet we are still very far from believing that the experiment has furnished us with sufficient data to arrive at a complete explanation of the phenomena of the radiometer. (4) We constructed a radiometer, in which three platinum wires, sealed into the glass covering, support each at its interior end a small copper disk. Two of the disks are vertical, but one (to the left of the author's diagram) is horizontal. With this instrument I experimented as follows:—I placed a lighted candle near this radiometer; it turned then from the left to the right. I put out the light, and when the radiometer was at rest I applied the current of a battery of 3 or 4 elements to a small Ruhmkorff coil. The ends of the fine wire of this coil were applied, the one to the exterior end of the platinum wire to the left, and the other to that at the right, the positive pole being connected with the left hand, when the radiometer turned in the same direction as above. If, whilst the radiometer was turning under the influence of the electric current, a lighted candle was brought near, the speed of the rotation increased considerably, a proof that the two actions took place in the same direction. We then placed the outer ends of the two platinum wires sealed in the glass in connection with a galvanometer whilst the radiometer was turning under the influence of a gas-jet. The needle of the galvanometer did not remain at rest, but described an angle of 5°. If the poles are inverted the radiometer stops. If the positive pole of the battery is brought near the exterior either of the base or the summit of the instrument it stops. The author expresses his intention of explaining these results in a future paper.

Scientific Information for Ladies!—In spite of all the efforts of the educational powers that be to spread scientific instruction amongst the people, the instances that daily crop up of the crass ignorance on matters of science, amongst even well-educated writers, are sufficiently amusing to the initiated. A wiseacre who has compiled the "Lady's Every-Day Book," describing castor oil, coolly informs us that "this very safe and common aperient is an oily substance secreted by the beaver. We obtain it both from Russia and America, but that obtained from the latter country is esteemed the best." We can fancy a fond mother trying to cram half an ounce of Russian castoreum, membranous bag and all, down her lovely infant's throat, under the impression that it was a "very safe aperient."

MEETINGS FOR THE WEEK.

MONDAY, 18th.—Society of Arts, 8. (Cantor Lectures.) "The History of the Art of Coach Building," by Mr. G. A. Thrupp. Lecture V. Rules of Coach-building; and The rules applicable to the Carriages of the Future.
—— Medical, 8.
—— London Institution, 5.
TUESDAY, 19th.—Civil Engineers, 8. (Anniversary).
WEDNESDAY, 20th.—Society of Arts, 8. "The Centennial Exhibition, Philadelphia, 1876," by Prof. Archer.
—— Geological, 8.
—— Meteorological, 7.
THURSDAY, 21st.—Royal, 8.30.
—— Chemical, 8.
—— Philosophical Club, 6.30.
FRIDAY, 22nd.—Quekett Club, 8.

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L. Bernard.—Send us an account of the analysis when you have made it.

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THE CHEMICAL NEWS.

Vol. XXXIV. No. 891.

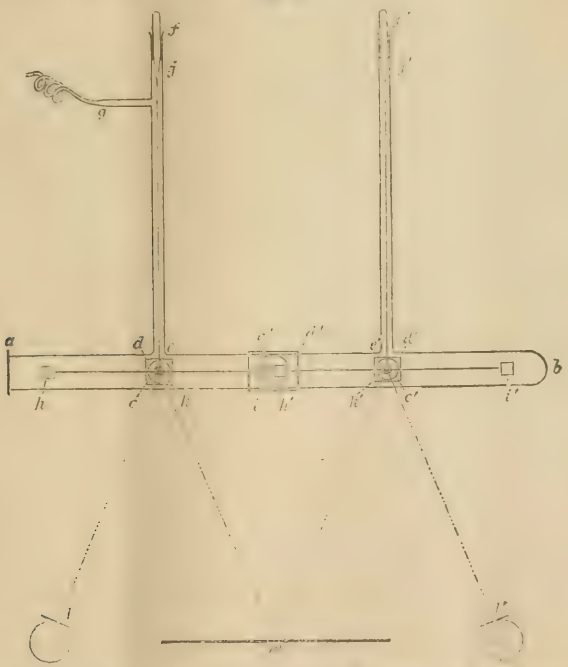
ON REPULSION RESULTING FROM RADIATION.—PART II.*

By WILLIAM CROOKES, F.R.S., &c.

(Concluded from p. 251).

115. It has already been said that when radiation falls on a thin surface of pith, the neutral point is low, whilst with a moderately thick piece of platinum it is generally high. I have constructed a double torsion apparatus by means of which these actions can be easily studied. Fig. 10 shows the arrangement of apparatus. It consists of a torsion apparatus constructed as the one shown in fig. 7 (102), with the exception of the arms being double. Similar parts in each drawing are shown by similar letters: *a b* is a piece of thin glass tubing, sealed off at the end *b*, and ground perfectly flat at the end *a*. In the centre a circular hole (*c''*) is blown, and two others are blown at the parts *c* and *c'*; the edges of these holes are also ground perfectly flat. *a*, *c*, *c'*, and *c''* can therefore be sealed up by cementing flat transparent plates of glass, quartz, rock-salt, &c., *a*, *d*, *d'*, *d''* on to them. At right angles to *a b*, and at the parts *c*, *c'*, upright tubes, *f e*, *f' e'*, are sealed, one of them having an arm (*g*) blown into it for the purpose of attaching the apparatus to the pump. *h*, *i*, *h'*, *i'* are glass beams made as light as possible consistent with the necessary stiffness. *j k*, *j' k'* are glass fibres (103) cemented at *j*, *j'* to pieces of glass rod, and terminating at *k*, *k'* with a stirrup cut from aluminium foil, in which the glass beams *h*, *i*, *h'*, *i'* rest. In front of these stirrups are thin glass mirrors (*k*, *k'*). At the ends of the beam (*h*, *i*) are cemented very thin pieces of blackened pith, each 1 centim. square; and at the ends of the other beam (*h'*, *i'*) are cemented pieces of platinum foil, also 1 centim. square. At *l* and *l'* are narrow slits, with lamps behind them, so arranged that they send their rays of light respectively on to the mirrors (*k*, *k'*), whence they are reflected back to the divided scale *m*. When the torsion beams are not acted on by any force, the rays of light both meet at zero (*m*), and there overlap, the slightest movement of either beam causing them to separate.

Fig. 10.



When the apparatus is full of air, a beam of radiation sufficiently wide to cover the whole window (*c''*) being thrown upon the plates *i*, *h'*, the latter are instantly attracted, as shown by the movement of the reflected rays of light (*k m*, *k' m*). On exhausting the tube and trying the effect of a hot body at the central window from time to time, it is seen that the movement of the pith surface (*i*) gradually diminishes, until at a certain point of ex-

* A Paper communicated to the Royal Society, March 20, 1875. From the *Philosophical Transactions of the Royal Society of London*, vol. clxv., pt. 2.

haustion (in this apparatus at about 50 millims. below a vacuum) the neutral point for pith is obtained. On increasing the rarefaction the pith is repelled by radiation, the platinum continuing to be attracted. On exhausting the air still further (to about 28 millims.) the neutral point for the platinum surface is obtained, higher rarefactions producing repulsion of each when radiation falls on the pith and platinum surfaces (*i*, *h'*).

At a rarefaction intermediate between the neutral point for pith (50 millims.) and the neutral point for platinum (28 millims.), the curious effect is produced of the same beam of radiation thrown into the window (*c''*) producing repulsion of the pith and attraction of the platinum, the two rays of light (*k m*, *k' m*) each moving to the right, and, if a piece of ice is presented to the central window, to the left. By adjusting the internal tension of the apparatus, a point may be reached (about 40 millims. below a vacuum) at which the repulsion of pith and the attraction of platinum are exactly equal, and then the two rays meeting at *m* do not separate, but together move to the right or left.

116. A series of experiments have been tried with a view to ascertain what influence the state of surface of the substance submitted to radiation has on the amount or the direction of its movement. A torsion apparatus was prepared similar to the one shown in fig. 7 (102), and having a thin disk of ivory at each end. One was coated with lampblack, whilst the other retained its white polished surface. The average of a number of experiments showed that, under the influence of the same source of radiation acting for the same time (15 seconds), the white ivory was repelled so as to send the luminous index 41·5 divisions of the scale, whilst the blackened ivory caused the index to move 46·8 divisions. These experiments were, however, tried in 1873,* when I had not succeeded in getting anything like the delicacy I now obtain in the apparatus; and I propose to repeat them under varied conditions before employing the results to found any arguments upon.

117. In my former paper on this subject (74, 75, 76, 77, 78) I have discussed various explanations which may be given of attraction and repulsion resulting from radiation; and in a lecture delivered before the Physical Society† I entered more fully into the same arguments. The most obvious explanation is that the movements are due to the currents formed in the residual gas, which, theoretically, must be present to some extent even in those vacua which are most nearly absolute.

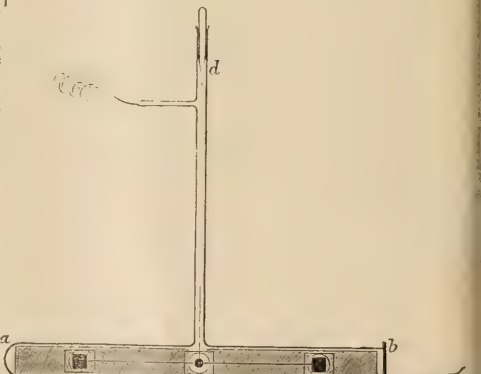
Another possible explanation is that the movements are due to electricity developed on the moving body, or on the glass apparatus, by the incident radiation.

A third explanation has been put forward by Professor Osborne Reynolds, in a paper which was read before the Royal Society on June 18th, 1874. Referring to the results of my experiments, Prof. Reynolds says that it is the object of his paper to prove that these effects are the result of evaporation and condensation. In my exhausted tubes he assumes the presence of aqueous vapour, and then argues as follows:—"When the radiated heat from the lamp falls on the pith, its temperature will rise, and any moisture on it will begin to evaporate and to drive the pith from the lamp. The evaporation will be greatest on that ball which is nearest to the lamp; therefore this ball will be driven away until the force on the other becomes equal, after which the balls will come to rest, unless momentum carries them further. On the other hand, when a piece of ice is brought near, the temperature of the pith will be reduced, and it will condense the vapour and be drawn towards the ice."

It is not my intention to recapitulate the arguments I have already brought forward against these three explanations. They are all fully given in my above-quoted lecture before the Physical Society. I shall, however, adduce a few experiments which have been devised specially with the view of putting one or other of these theories to the test. In giving what I conceive to be reasonable arguments against the explanations which have already been proposed, I do not, however, wish to insist upon any theory of my own to take their place. *Any* theory will account for *some* facts; but only the true explanation will satisfy *all* the conditions of the problem, and this cannot be said of either of the theories I have already discussed.

118. The pendulum apparatus, described and figured in paragraph 99, was specially devised to bear upon the air-current and the electrical theory. On referring to the description of the experiments tried with it (Tables I. and II.), it is seen that in air the ignited spiral produced attraction, whilst in a vacuum the same source of radiation gave strong repulsion. Now the effect of raising a platinum spiral to whiteness in the air would be to rarefy the air all round, and the suddenness of its ignition would cause the air to be driven from it, as a centre, on all sides. Hence I was prepared to find that the pendulum would be mechanically blown on one side by what might be likened to a miniature explosion of heated gas. But the action was always one of attraction, whilst, when there was no air at all present to be expanded and driven away by the hot platinum, the action was one of violent repulsion. A possible explanation of the attraction in air in this experiment may be given by assuming that the pendulum was driven inwards by the rush of cold air supplying the place of that rising upwards from the hot spiral; but it is not likely that this action should so completely overcome the effect of expansive action; and, moreover, it will only account for half the phenomenon (that in air), and leaves the still stronger action in a vacuum entirely unexplained.

FIG. 11.



119. I have tried special experiments to put the air-current theory to a decisive test. Bulb tubes (84) and torsion apparatus (102) have been prepared, containing terminals of metal, ivory, glass, mica, or pith, in the form of thin flat surfaces. These surfaces have been placed at an angle with the plane passing through the index and suspending thread in such a manner that the action of heat would be to cause currents and drive them round like the vane of a windmill. I, however, found the action of heat *in vacuo* to be repulsion, and in air to be attraction; and the latter was even strong enough to overcome the action of the air-currents, which could not fail to be developed under the circumstances of the experiment.

* The torsion apparatus with ivory terminals was exhibited in action at the meeting of the Royal Society, Dec. 11, 1873.

† June 20, 1874 (*Phil. Mag.*, August, 1874).

120. The pendulum apparatus has also been used to show that electricity is not the cause of the attraction and repulsion. On referring to the description (99) it is seen that the mass of magnesium forming the weight was in metallic contact with the platinum wire which supported it, and that the upper end of this platinum wire was fused into the glass tube, and passed thence to the outside. With this I have tried numerous experiments bearing on the action of electricity. I have connected the projecting end of the platinum wire with "earth," with either pole of an induction-coil (the other pole being more or less insulated), with either pole of a voltaic battery, and with a delicate electroscope; I have charged it with an electrophorus, and have submitted it to the most varied electrical conditions; and still, on allowing radiation to fall on the suspended mass, I invariably obtain attraction in air and repulsion in a vacuum. The heat has been applied from the outside, so as to pass through the glass, and also inside by means of the ignited spiral; and the results show no difference in kind, but only in degree, under electrical excitement. I often obtain troublesome electrical interference with the usual phenomena, but never of such a character as would lead me to imagine that the normal results were due to electricity. I also obtain the normal actions whether the apparatus has been standing insulated in the air, or whether it has been completely immersed in water connected electrically with "earth" or surrounded with wet blotting-paper.

121. The following experiment was suggested by Mr. Cromwell F. Varley, F.R.S., who informs me that he considers the results conclusive against the electrical theory. A torsion apparatus was prepared, as shown in fig. 11. The inside of the tube (*a b*) is lined with a cylinder of copper gauze, having holes cut in the centre (*c*) for the passage of the supporting thread (*d c*) and the index ray of light, and holes at each end to admit of the plates (*e, f*) being experimented with. A hole drilled in the plate (*b*) allows a wire to pass from the copper gauze to the outside, so as to give me electrical access to the gauze lining. Under the most diverse electrical conditions, whether insulated or connected with "earth," this apparatus behaves normally when heated; neither can I detect any electricity when the plate *e* or *f* is under the influence of radiation if I connect the wire *g* with a delicate electroscope. In experimenting with this apparatus I have also completely immersed it in liquids, such as water, solutions of metallic salts, ether, disulphide of carbon, &c. The heat has been applied in these cases by introducing a glass bulb containing water at different temperatures and a thermometer (28). Under all these varied circumstances the movements took place in a regular manner, and no electrical action whatever could be detected.

122. I have already discussed Prof. Osborne Reynolds's theory of evaporation and condensation somewhat fully in the already quoted Physical Society paper.* I will, however, describe the following experiments, which I think prove that Prof. Reynolds has not suggested a theory which accounts for all the facts of the case, and therefore has not hit upon the true explanation.

A thick and strong bulb was blown at the end of a piece of very difficultly fusible green glass, specially made for steam-boiler gauges. In it was supported a thin bar of aluminium at the end of a long platinum wire. The upper end of the wire was passed through the top of the tube and well sealed in for electrical purposes (120). The apparatus was sealed by fusion to the Sprengel pump, and exhaustion was kept going on for two days, until an induction spark refused to pass across the vacuum. During this time the bulb and its contents were several times raised to a dull red heat. At the end of two days' exhaustion the tube was found to behave in the same manner as, but in a stronger degree than, it would in a less perfectly exhausted apparatus, viz., it was repelled by light and heat of low intensity and attracted by cold.

A similar experiment was next tried, only water was placed in the bulb before exhaustion. The water was then boiled away *in vacuo*, and the exhaustion continued, with frequent heating of the apparatus to dull redness, for about forty-eight hours. At the end of this time the bar of aluminium was found to behave exactly the same as the one in the former experiment, being repelled by radiation.

Similar experiments, attended with similar results, were tried with a platinum and with a glass index; and instead of water, iodine has been put into the bulb to begin with.

It is impossible to conceive that in these experiments sufficient condensable gas or vapour was present to produce the effects Prof. Osborne Reynolds ascribes to it. After the repeated heating to redness at the highest attainable exhaustion, it is difficult to imagine that sufficient vapour or gas should condense on the movable index to be instantly driven off by a ray of light or even the warmth of the finger with recoil enough to drive backwards a heavy piece of metal.

123. It seems to me that a strong argument against Prof. Reynolds's theory (and also against the electrical and air-current theories) may be drawn from the fact that the repulsion in a vacuum is not confined to those red and ultra-red rays of the spectrum which mainly produce dilatation of mercury in a thermometer, excite an electrical current between antimony and bismuth couples, and cause a sensation of warmth when falling on the skin, but that any ray from the ultra-red to the ultra-violet will produce a similar effect. It cannot be reasonably argued that a ray of light, filtered through plates of glass and alum (109), can instantly vapourise a film of moisture or condensable gas from a surface on which it is caused to shine, or that it can produce air-currents in the almost perfect vacuum surrounding the surface shone upon, or that it will produce electrical excitement on such a surface.

124. Facts tested and verified by numerous experiments, but scarcely more than touched upon in the present paper, are, I think, gradually shaping themselves in order, in my mind, and will, I hope, aid me in evolving a theory which will account for all the phenomena. But I wish to avoid giving any theory on the subject until I have accumulated a sufficient number of these facts. The facts will then tell their own tale; the conditions under which they invariably occur will give the laws; and the theory will follow without much difficulty. In the eloquent words of Sir Humphry Davy, "When I consider the variety of theories which may be formed on the slender foundation of one or two facts, I am convinced that it is the business of the true philosopher to avoid them altogether. It is more laborious to accumulate facts than to reason concerning them; but one good experiment is of more value than the ingenuity of a brain like Newton's."

Loc. cit.: also CHEMICAL NEWS, July 17, 1874.

ON THE

PHYSICAL AND CHEMICAL PROPERTIES OF RUTHENIUM.

By H. SAINTE-CLAIRE DEVILLE and H. DEBRAY.

RUTHENIUM, if heated in oxygen, is not transformed, like osmium, into a product volatile at 100°, but yields an oxide, RuO_2, which does not sublime appreciably unless heated to bright redness. To obtain the hyper-ruthenic acid (RuO_4) of Claus, the analogue of osmic acid (OsO_4), it is necessary to attack ruthenium, well purified from osmium, with a mixture of nitre and potassa. It is thus converted into an orange-yellow soluble ruthéniate, and the solution of this salt, saturated with chlorine and distilled in the water-bath in a current of this gas, yields volatile hyper-ruthenic acid, which condenses in gold-coloured globules or crystals. The ruthenium employed in the further experiments of the authors was obtained by

the reduction of this acid, and consequently cannot contain any trace of the other metals of the platinum group.

A solution of hyper-ruthenic acid in potassa, treated with alcohol, gives oxide of ruthenium, which is reduced to a metallic state by coal-gas at a temperature slightly elevated. The metal is afterwards alloyed in a crucible of charcoal made in a retort, purified by chlorine, with five or six times its weight of pure tin. The ingot, treated with boiling muriatic acid, which dissolves the excess of tin, leaves an alloy of ruthenium and of tin crystallised in cubes, having the planes of a rhomboidal dodecahedron (angles at 90° and 135°), and containing equal equivalents of tin and ruthenium. We grind it finely in a glass mortar, and it is introduced into a small boat of purified charcoal, which is strongly heated in a porcelain tube traversed by a current of dry and pure muriatic gas until the matter no longer loses weight. The tin is volatilised entirely in the state of protochloride, and we recover, without any loss, the weight of the ruthenium upon which we have operated, but it is transformed into a crystalline matter. We obtained for the density of this matter the following numbers :—

Weight in the air at 21° and 760 m.m...	74·2490 grm.
Loss of weight in water at 21°	6·0265 grm.
Density at zero	12·261

We admit in all these calculations the coefficients of dilatation published by M. Fizeau in the *Annuaire du Bureau des Longitudes*.

The determination of pulverulent matters like ruthenium requires minute precautions, without which we dot not obtain accordant numbers, even if we operate on one and the same substance. But we cannot describe here in detail the apparatus which we were obliged to employ to moisten completely the matter, and not to leave in the interior of the powder any trace of gas, and to avoid other causes of error.

When hyper-ruthenic acid is prepared by passing chlorine into a concentrated solution of the orange ruthéniate of potassa, there is a moment when the liquor becomes deep green, and is filled with small black crystals. If we decant at this moment we may isolate the crystals, purify them from their mother-liquor and from chloride of potassium by a rapid washing, and finally dry them, first on unglazed porcelain, then in a vacuum over caustic potash and lime. These crystals have very brilliant planes, which are orthorhombic octahedra, derived from a prism of 117°. They are isomorphous with permanganate of potassa. The solution of this salt is a deep greenish black, like the salt itself. It decomposes very rapidly into oxide of ruthenium, which is deposited, and into orange ruthéniate of potassa. Hyper-ruthenic acid, RuO_4, does not seem able to combine with bases. If a fragment of it is dropped into solution of potassa it is dissolved very slowly, disengaging oxygen, and producing the deep green salt with which we are now engaged. This salt is composed of—

Ruthenium ..	1034	50·00	Ru_2	= 50·34
Potassa	469	22·44	KO	= 22·66
Oxygen	569	27·46	O_7	= 27·00
Water	8	0·38		—
	2080	100·28		100·00

The salt, if weighed in a platinum boat placed in a glass tube, and gently heated in a current of hydrogen, takes fire, disengaging much water. If we replace hydrogen by carbonic acid a fresh quantity of water distils. If this water is collected in a chloride of calcium tube, and its weight determined, we may deduce the quantity of oxygen contained in the acid of the salt. There remains in the boat a mixture of ruthenium and of carbonate of potassa, which is weighed with the usual precautions, and which is separated with the greatest facility. Chlorine decomposes the new salt, Ru_2O_7,KO, or Ru_2O_8K, taking possession of the potassium, and giving even at a common temperature hyper-ruthenic acid, Ru_2O_8, in vapour, without sensibly disengaging oxygen.

On this property is founded another method of analysis, which we have tried, and which gave results corresponding with those cited above. Conforming to the nomenclature adopted by M. Fremy when he discovered osmious acid, and respecting as much as possible the nomenclature of Claus, we shall propose to call—

Ruthenous Acid, RuO_3, giving with potassa yellow-orange solutions.

Hepta-ruthenic Acid, Ru_2O_7, giving with potash a black salt, of which the solution is deep green.

Finally, *Hyper-ruthenic Acid*, the acid RuO_4 of Claus, which does not combine with potassa, and of which the characteristic property is to be volatile, to possess even below 100° a considerable vapour-tension, and to decompose with explosion at 108°, as we have unhappily learnt at the expense of our stock of ruthenium.

Analysis of Ruthenium and its Alloys.—Though the purity of the ruthenium employed in our researches was guaranteed by its method of preparation, we have nevertheless analysed it. We shall describe in detail the method used for this analysis, which is suitable as well for pure ruthenium as for its alloys. We attack 0·5 grm. of ruthenium with a mixture of 5 grms. potassa and 2 grms. pure nitre in a gold crucible, and heat to redness. The metal disappears entirely, yielding a limpid liquid, which we dissolve in water after solidification and cooling. The crucible is washed with pure hypochlorite of soda, and the whole liquid transferred to a distillatory vessel of glass consisting of a balloon with a ground stopper, and fitted with two tubes blown to the balloon, one of which serves to introduce a current of chlorine into the liquid, and the other serves for the exit of the vapours disengaged, and conducts them into another balloon containing a solution of potassa. The ruthenite of potassa is first saturated with chlorine; the solution, at first orange, becomes a blackish green and then a golden yellow, because there are formed successively hepta-ruthenate, KO,Ru_2O_7, and hyper-ruthenic acid. We heated then the balloon in the water-bath to 80°, continuing to pass a slow current of chlorine. Yellow globules or crystals of hyper-ruthenic acid are condensed in the tube which connects the balloon of the receiver, and were gradually carried into the alkaline liquid. With 30 grms. of potassa in the receiver we are sure not to let hyper-ruthenic acid escape, if the current of chlorine is not intense enough completely to saturate the potassa. Nevertheless, we adapt to the receiver an abducting tube plunging into alcohol, which would arrest the least traces of hyper-ruthenic acid, and convert them into chloride of ruthenium. It must be noted that neither corks, nor especially caoutchouc, can serve to close or to connect the different pieces of this apparatus.

We must not expect to distil all the rutheniumin a single operation. We let the liquid of the balloon cool, we render it alkaline by adding a few pieces of potassa, and we recommence the preceding operation by putting into the receiver a fresh solution of potassa. If the liquid is no longer coloured, at first green then orange-yellow, on the first contact with alcohol, this is a proof that the distillation no longer gives hyper-ruthenic acid: the operation is then terminated.

To withdraw ruthenium from the alkaline solutions where it is condensed, we add to these a small quantity of alcohol; the greenish liquor becomes orange-yellow, then turbid, and deposits even in the cold oxide of ruthenium, retaining a little alkali, which is carried off by washing first with water, afterwards with a dilute solution of sal-ammoniac, and finally with pure water. The filter upon which we received the oxide of ruthenium is introduced into a counterpoised boat of porcelain, which is itself placed in a larger capsule covered with a funnel, by the tube of which coal-gas is caused to enter. When the air has been expelled from the funnel we heat the capsule on a gas-furnace at a temperature not exceeding 500°; the oxide of ruthenium is reduced at first, and the paper is carbonised. We then

place the boat in the muffle of a gas-furnace, and burn there the carbon by heating it to dull redness. The oxide of ruthenium which is then formed is not yet volatile at such temperatures: there only remains to reduce it by purified hydrogen. For that purpose we introduce the boat into a glass tube, through which we pass hydrogen, which reduces the oxide with incandescence. We complete the reduction at dull redness, and allow to cool in a current of carbonic acid. We weigh the metal, after having washed it in water, which carries off traces of chloride of potassium. It is even indispensable to verify the weight of the metal after having digested it in a platinum vessel with diluted hydrofluoric acid, which dissolves a quantity of silica, often appreciable, derived from the vessels and filters. The 500 m.grms. of ruthenium taken yielded 498 m.grms. of metal, that is, four-thousandths of loss, which may be easily explained by the unavoidable removal of matter, produced when we attack the metal in the gold crucible in consequence of the disengagement of gas from the nitre. The liquid remaining in the balloon gave traces of iron, derived from hypochlorite, and 4·8 m.grms. of gold derived from the crucible. If we wish to determine the ruthenium contained in an alloy attackable by aqua regia we dissolve it, and after having evaporated the excess of acid introduce the solution of the chlorides into the distillatory apparatus described above, and add to it an excess of potassa and hypochlorite. This mixture, saturated with chlorine and distilled as has been said, gives off, after one or several treatments with potassa and chlorine, all its ruthenium in a state of volatile hyperruthenic acid. Our note of November 15, 1875, contains the method which is proper to employ in the case where ruthenium is associated with iridium, and forms with it an alloy unattackable in aqua regia. We shall only recal that it is by the aid of baryta and nitrate of baryta, or bioxide of barium, that we cause these metals to enter into solution. Thus, transforming the ruthenium into a very volatile product, which does not permit it to be confounded with any other body, we give to the determination of this metal a security which cannot be obtained by any other method.—*Comptes Rendus.*

ON ANTHRACEN TESTING.

By R. LUCAS.

Experience with the "anthraquinon test" has taught us that the anthraquinon obtained is not pure anthraquinon. I have made some experiments to obtain chemically pure anthraquinon by increasing the quantity of chromic acid. By taking 15 grms. of chromic acid and boiling for four hours without using the "appendix," I obtained the same results as with the usual anthraquinon test with appendix. I now increased the chromic acid to 20 grms. and boiled for six hours, but there was no alteration in the result, and the chromic acid seems not to act further on the impurities so long as the chromium salt and oxidation products are present. But if we finish the test in the usual way, and treat the anthraquinon again with chromic acid, some of the impurities are destroyed, but the result is not chemically pure anthraquinon. Dr. Versmann published in the Chemical News (vol. xxxiv., pp. 178, 192, and 202) some very interesting experiments on anthraquinon, and he proposed (Chemical News, vol. xxxiv., p. 178) a new anthracen test by separating the crystals and powder resulting from the anthraquinon test. I have tested a number of samples of anthracen by Dr. Versmann's new test and examined the crystals and powders separately for anthraquinon. The crystals which I obtained by Dr. Versmann's method were not all chemically pure anthraquinon; they lost in weight when treated by the anthraquinon test. The powders I dissolved in glacial acetic acid and separated them each again in crystals and powder. The crystals obtained in this way contained a large quantity of anthraquinon, which I have converted into alizarin, and even the powder contained still a small quantity of anthraquinon.

The determination of the melting and solidifying-point of the powder has no practical value; it only might teach us that the powder is not pure anthraquinon, but it does not show us whether it contains anthraquinon, just what we want to know in our case.

We know that a small amount of impurities alters the melting-point of organic substances considerably, and we are not justified to accept Dr. Versmann's compromise by considering the powder as valueless impurity in all cases where the melting- and solidifying-point is below 270° or above 280° C. It is nearly impossible to determine the "exact" melting-point of the powders on account of the dark colour which some of them assume on being heated. This alone would lead to disputes, and the results of Dr. Versmann's new test will be in most cases too low.

How misleading the determination of melting-points sometimes are we know if we go back to the time of the alcohol test, where samples of anthracen were rejected "as containing no anthracen at all," because the melting-point was under 190° C. I have tested some of these identical residues of the alcohol test of the low melting-point of 170° C. by the anthraquinon test, and found that they contain more real anthracen than other residues showing the melting-point of 205° C., and in the case of refined anthracen the melting-point shows nothing at all. I have tested a number of samples all of the same mean melting-point, 210° C., by the quinon test, and their percentage varied from 45 per cent to 99·5 per cent of anthracen.

Of all the anthracen tests which have been published Messrs. Meister, Lucius, and Brüning's "new and improved test" (Chemical News, vol. xxxiv., p. 167) treatment of the quinon with fuming sulphuric acid, &c., comes the nearest to the truth. The anthraquinon obtained by this test is not chemically pure, and Meister, Lucius, and Brüning stipulate, therefore, to volatilise the product obtained and to deduct the carbon and ash from the weight of the anthraquinon, and only the volatile part represents the pure anthraquinon. The volatilisation of the quinon is objectionable, because it is very difficult to volatilise the anthraquinon completely without burning some of the carbon. Chemically pure anthraquinon can be volatilised completely without leaving a mark if heated carefully, but if it is heated too quick and some drops of the anthraquinon fall back on the heated bottom of the crucible some carbon remains.

To overcome this difficulty of volatilising the quinon, and to make the test more exact, I propose the following alteration and addition to Messrs. Meister, Lucius, and Brüning's new test. Instead of volatilising the quinon, I dry it on the filter and treat it again by the anthraquinon test with chromic acid. The whole test would now read as follows:—

Take 1 grm. of anthracen, place it in a flask of 500 c.c. capacity with upright condenser, add to it 45 c.c. of glacial acetic acid, and heat to ebullition. To this solution (which is kept boiling) add, drop by drop, a solution of 15 grms. of chromic acid in 10 c.c. of glacial acetic acid and 10 c.c. of water. The addition of the chromic solution should occupy two hours, after which the liquid is to be kept boiling for two hours longer, four hours being required to complete the oxidation. The flask with its contents is to be kept standing for twelve hours, then mixed with 400 c.c. of cold water, and again kept standing for three hours. The precipitated anthraquinon is now collected on a filter, and washed, first with pure water, then with boiling dilute alkaline solution, and finally with pure water. The quinon is now washed from the filter into a flat dish and dried at 100° C. It is then mixed in the same dish with 10 times its weight of fuming sulphuric acid (sp. gr. 1·88) and heated to 100° C. for ten minutes on a water-bath. It is then taken at once from the water-bath

and kept in the same dish for twelve hours in a damp place to absorb moisture. Then add 200 c.c. of cold water to the contents of the dish, collect the precipitated quinon on a filter, and wash, first with pure water, then with boiling alkaline solution, and again with pure hot water, and finally dry.

The quinon is now removed from the filter and put into a flask of 500 c.c. capacity, and the small quantity of quinon remaining on the filter paper is washed off with 45 c.c. of hot glacial acetic acid into the same flask. Now heat to boiling and add slowly a solution of 15 grms. of chromic acid in 10 c.c. of glacial acetic acid and 10 c.c. of water and boil for four hours. The flask with its contents is kept for twelve hours, then mixed with 400 c.c. of cold water, and again kept standing for three hours. The precipitated anthraquinon is now collected on a double filter, and washed, first with pure water, then with boiling dilute alkaline solution, and again with pure water, and finally dried at 100° C. until constant in weight. The weight of the quinon obtained is to be calculated in the usual manner into anthracen. The quinon obtained should always be tested for ash, and the weight of the ash deducted from the weight of the quinon before calculating it into anthracen.

A few words about anthracen might be interesting to tar distillers. Some people believe that anthracen showing a low percentage is identical with a low quality anthracen, and that a high percentage anthracen must always be of good quality. This is an error. Some tar distillers push the distillation of the tar or of the anthracen oils too far and they get an anthracen of inferior quality, because it is principally the last portion of the distillate containing the so-called pitch anthracen, which is of inferior quality, and some of the alizarin makers stipulate, therefore, in their contracts "the anthracen must not be made from pitch." My experience is that anthracen of bad quality cannot be improved by simply pressing, and that the quality is not always improved by washing with solvents. But the quality of inferior anthracen is improved (1) if the anthracen in question has not been filtered and pressed by a re-distillation of the same, leaving the last portion as pitch in the still, and (2) if the anthracen has already been pressed by a systematical re-crystallisation from solvents.

THE POTASH THEORY OF SCURVY.

THE discussion which has recently been carried on in the columns of *The Times* respecting the outbreak of scurvy on board the "Arctic" vessels has recalled to our notice an article published in this journal in 1867 (CHEMICAL NEWS, vol. xv., p. 37), in which we referred to the views of the late Baron Liebig and other high authorities, who held that the value of lime-juice as an anti-scorbutic is due solely to the potash which it contains. It may serve a useful purpose if we reproduce extracts from this article. At any rate they will show the importance of lime-juice being tested by competent analysts:—

"Lime-juice is used in the English Navy and Merchant Service as an efficient anti-scorbutic. Amongst American seamen scurvy is almost unknown, and this immunity has been ascribed to the very general use of potatoes; whilst in France and Russia the rareness of this disease is similarly ascribed to the almost universal consumption of thin light wines as a beverage. Rice, which has been frequently proposed as a substitute for potatoes, has, however, been proved to be utterly valueless as an anti-scorbutic. Again, the evil effects of salt meat are notorious, but fresh beef alone is capable of preserving health for almost any time.

"These facts are found to agree perfectly with the potash theory of scurvy. The mineral constituents of lemon-juice are found to be extremely rich in potash, containing, according to Mr. Witt, upwards of 44 per cent of this alkali. There is an opinion that the juice of the lime (*Citrus limetta*) is stronger and more acid than lemon-juice, but in chemical constitution there is not much difference between the two. Fresh vegetables, as a rule, are rich in potash salts; potatoes, which may be placed at the head, containing no less than 51 per cent in their ash, according to Way and Ugston, and 55 according to Griepenkerl. Grape-juice, which may be considered as the representative of the light wines so largely used in the French and Russian marine, contains in its ash from 60 to 70 per cent of potash, while the husks of grapes have an ash containing 37 per cent. Rice, however, contains only 20 per cent in its ash.

"Dr. Garrod, who has examined various kinds of food in reference to this point, gives the actual amount of potash contained in different alimentary substances. From this we learn that—

One ounce of rice		contains 0·005	gr. of potash.
"	lemon-juice	" 0·852	"
"	boiled potato	" 1·875	"
"	raw beef	" 9·599	"
"	salt beef	" 0·394	"

"But without assuming that the active principle of these various anti-scorbutic foods is the potash which they contain, there is no doubt whatever that chemical analysis is abundantly able to show the quality of lime-juice in an accurate and rapid manner. The constituents of lime-juice are not many, the organic part contains citric acid, mucus, vegetable albumen, pectin, and sugar; whilst the inorganic constituents consist nearly half of potash, and the rest of the ordinary ingredients of the ash of plants. It is certain that most of these have no action as far as scurvy is concerned, and a little investigation could not fail to show whether the specific consisted of the potash or some other constituent. The work of the analyst would then be to see *generally* that the article was in a state fit for food and likely to keep, and *specially* to see that the percentage of the active ingredient did not sink below a certain standard. Too much stress has been laid on the considerable time which it is supposed lime-juice would take to analyse; and Dr. Leach has stated 'authoritatively that any juice may be safely pronounced good, bad, or indifferent in *from twenty to thirty hours* after its receipt by the inspecting officer.' This is far longer than would be required. When once the appliances for such analyses were in working order, we do not hesitate to say that a skilful chemist would supply all the necessary information in a couple of hours.

"Assuming, as will most likely prove to be the case, that the potash salts are the specific agents against scurvy, chemical analysis is seen to be indispensable in the selection of anti-scorbutics for use on board ship. It then, however, becomes a question whether the active agent could not be stored and administered with far more economy, ease, and efficacy in the form of some convenient pharmaceutical preparation (such as the granulated effervescing citrate of potash) than when given through the exceedingly unscientific, clumsy, and ofttimes repulsive expedient of serving out lemon-juice to the men. It might also be worth while to ascertain whether the desired end could not be secured by letting chloride of potassium partially replace chloride of sodium in the preservative processes to which the provisions are subjected.

"Whether every sample of lime-juice should be separately examined before shipment, or whether Dr. Stone's suggestion be adopted of licensing a limited number of lime-juice vendors, and occasionally verifying the genuineness of their commodity by analysis, is a matter which need not at present be discussed."

University of London.—The following candidate has passed the recent examination in Public Health:—H. Franklin Parsons, M.D. (gold medal), St. Mary's Hospital.

PROCEEDINGS OF SOCIETIES.

PHYSICAL SOCIETY.

December 16th, 1876.

Professor G. C. FOSTER, F.R.S., President, in the Chair.

THE following candidate was elected a Member of the Society:—Mr. W. Baily, M.A.

Mr. CROOKES described some of the most recent results he has obtained in his experiments on the radiometer, and exhibited many beautiful forms of the apparatus, most of which have been devised with a view to decide on the correct theory of the instrument. He commenced by describing the arrangement he has used for some time past in studying the resistance offered by air and other gases to the rotation of a mica disc. It consists of a mica plate suspended by a fibre of glass, and enclosed in a chamber which can be exhausted to any required extent. A mirror is attached to the mica, and the movement of a luminous point reflected from it shows that the decreasing swings form a logarithmic curve, and Mr. Crookes takes the logarithms of the decrements of the swings as a measure of the viscosity of the gas under examination. From the normal atmospheric pressure to the best vacuum which can be obtained by the ordinary air-pump this decrement remains nearly constant, and these experiments have been carried on in vacua of remarkable perfectness, the highest exhaustion obtained being represented by 1 millimetre on a scale of 10 miles, a point which was attained by means of a Sprengel pump with improvements by Mr. Gimingham, and measured by a McLeod gauge. If the "logarithmic decrement" be represented by 125 at a pressure of 760 m.m., it is not reduced to 70 until the pressure has been reduced to 35-millionths of an atmosphere, and at this point the action of light on a radiometer is at a maximum. On continuing the exhaustion this influence is found to decrease, and Mr. Crookes concludes that in a perfect vacuum the log dec. would not be zero, but about 0·01; that is, a mica plate would not continue to oscillate for ever, a fact probably due to the viscosity of the glass fibre. About fifteen different forms of the radiometer were exhibited, and their inventor has satisfied himself that the theory of their action proposed by Mr. G. Johnstone Stoney is the only one capable of completely accounting for their action, and he considers it to be in all probability the correct one. By means of a double radiometer, consisting of two globes of different diameters, and having a wide opening between them, and provided with a four-armed fly which can be made to rotate in either bulb, it has been shown that, other things being equal, the velocity of rotation decreases as we increase the diameter of the bulb. As, on the molecular-movement theory, the rotation is due to a throwing off of particles from the blackened surface of the mica, it follows that, if a piece of transparent mica be attached to each fly in front of the blackened surface, the rotation will take place in the opposite direction, and this proved on experiment to be the case. And, further, when such a plate is placed on either side of the vanes, the motion of the instrument is almost entirely stopped. As these facts can be explained on the "molecular movement" or the "evaporation and condensation" theory, Mr. Crookes arranged a radiometer having four transparent mica vanes, and mounted in a rather large bulb. At the side of the bulb a plate of mica, blackened on one side, is so fixed in a vertical plane that the vanes can pass, and when light shines on this fixed plate the fly is found to rotate, a fact which in itself disproves the latter theory. Many other curious forms were exhibited, in some of which the vanes were cup-shaped, as Mr. Crookes has found these to act as well as the ordinary form, a convex surface acting as though it were blackened. In conclusion, he exhibited a photometric four-vaned radiometer, in which the fly was attached to a small magnetic needle, and this might be so checked by an external magnet that the strongest light would be incapable of causing the needle and vanes to make a half rotation. If the circumference of the globe be graduated, and the apparatus be brought within the influence of a source of light, the angle to which the needle is deflected will be a direct measure of the intensity of the light, and Mr. Crookes showed that by a simple arrangement such an instrument might be rendered self-recording.

Prof. DEWAR exhibited a simple electrometer which he has designed, founded on the discovery of Leipman that the capillary constant is not really independent of the temperature or the condition of the surface, but is a function of the electromotive force. If a capillary tube be immersed in mercury, and dilute sulphuric acid be placed in the tube above the mercury, and a current from a Daniel's cell be so passed through the liquids that the mercury forms the negative pole, the column will be depressed to an extent dependent on the diameter of the tube. In making an electrometer, Prof. Dewar has increased the sensitiveness by connecting two vessels of mercury by means of a horizontal glass tube filled with the metal, except that it contains a bubble of dilute acid. The tube must have an internal diameter of 2 millimetres, and it is essential that it be perfectly clean, uniform in diameter, and horizontal. The instruments exhibited were constructed by Messrs. Tisley and Spiller, and Prof. Dewar showed that it is possible by means of them to measure an electromotive force equal to 1-10,000th of a Daniel's cell; forces capable of decomposing water must be measured by causing two currents to act against each other. The index bubble is brought to zero by uniting the mercury cups by a wire. The apparatus is very convenient, as it requires no preparation, and is extremely simple in its action. He then showed an instrument arranged by Mr. Tisley for producing a current by the dropping of mercury from a small orifice into dilute sulphuric acid. If the vessels containing the mercury and the sulphuric acid be connected by a wire a current is found to traverse it, and Prof. Dewar explained how the electrolysis of water might be effected by this means. He then exhibited a delicate manometer suitable for measuring very slight variations of pressure, and he illustrated the use of it for proving Laplace's law that the internal pressure, multiplied by the diameter of a soap-bubble, is constant. It consists of a U-tube, one arm of which is about 15 inches long, and is bent horizontally, and levelled with great care. If the shorter arm be connected with a tube on which a bubble has been blown, and the diameter of the bubble be varied, the position of the extremity of the alcohol column will be found to vary in accordance with the above law.

DEUTSCHE CHEMISCHE GESELLSCHAFT, BERLIN.

November 27th, 1876.

Prof. A. W. HOFMANN, F.R.S., President, in the Chair.

F. WÖHLER, "*Action of Palladium in an Alcohol Flame.*" Palladium held in an alcohol flame is rapidly covered with carbon. The author supposed this to be due to its affinity for hydrogen, but finds by experiment that palladium does not decompose ethylen and the various gases of the alcohol flame below a red heat, although below the decomposing temperature of ethylen. He suggests the possibility of a temporary absorption of hydrogen, as in the case of copper heated in ammonia gas.

E. BAUMANN, "*Synthesis of Hydrogen-Phenyl-Sulphate and its Homologues.*" This compound, which the author discovered in urine, is easily obtained by the action of pyrosulphate of potassium, $K_2S_2O_7$, on a concentrated aqueous solution of potassium phenylate. Corresponding compounds of cresol and resorcin are obtained in a similar way.

H. Willgerodt, "*Action of α-Dinitro-chloro-benzol upon Acetamide.*" The two alone give no reaction at a temperature of 150°, but upon addition of magnesia ortho-para-nitraniline is obtained. The reaction with acetamide is much more difficult than that with oxamide.

H. Willgerodt, "*Action of α-Dinitro-chloro-benzol upon Carbamide.*" The reaction has been studied under a great variety of circumstances in the attempt to introduce the dinitro-phenyl radical into carbamide. In all cases, however, dinitraniline (melting-point 180°) has been obtained, and the carbamide has been completely decomposed.

L. F. Nilson, "*Plato-nitrites and Diplato-nitrites.*" The author has studied the double nitrites of platinum monoxide and the metals. He regards these compounds as containing the radical $(PtO_2(NO)_4$, which he terms *plato-tetra-nitrosyl*. The acid previously regarded as acid nitrite of platinum is plato-nitrosylic acid, and the salts plato-nitrites. With some metals he has obtained diplato-nitrites, containing the radical $Pt_2O_3(NO)_4$. Salts have been prepared with thirty various metals. These salts are generally obtained as fine crystals, are as a rule easily soluble in water, and not decomposed at 100°. Beryllium, iron, and indium form diplato-nitrites only.

Albert Atterberg, "*Derivatives from α-Dinitro-naphthalin and β-Dinitro-naphthalin.*" From α-dinitro-naphthalin the following compounds have been prepared:—dinitro-γ-dichloro-naphthalin, $C_{10}H_4Cl_2.2NO_2$; chlor-naphthylamin-hydrochlorate, $C_{10}H_6Cl.H_2N.HCl$; chlor-naphthylamin-sulphate, $C_{10}H_6ClH_2N.H_2SO_4$; and chloro-naphthylamin, $C_{10}H_6Cl.NH_2$. β-dinitro-naphthalin on treatment with phosphoric pentachloride yields large quantities of δ-trichlor-naphthalin, with a small amount of a new dichlor-naphthalin, which receives the distinctive mark ζ. The properties of δ-trichlor-naphthalin have been thoroughly examined, and the compound changed into a dichloro-phthalic acid, showing that only two of the three chlorine atoms are upon the same half of the naphthalin molecule.

A. Atterberg, "*On the Constitution of some Naphthalin Compounds.*" A consideration of the positions in the naphthalin molecule of doubly- and trebly-substituted chlorine derivatives.

Karl Heumann, "*Apparatus for the Representation of the Manufacture of Sulphuric Acid.*" A description of an ingenious arrangement for a lecture experiment.

W. Thörner, "*Derivatives of Para-tolyl-phenyl-ketone.*" By the treatment of para-benzoyl-benzo-trichloride, $C_6H_5—CO—C_6H_5—CCl_3$, resulting from the action of chlorine upon para-tolyl-phenyl-ketone; with phosphoric pentachloride oxygen is replaced by chlorine, and a ketone pentachloride obtained. The rest of the paper is occupied with theoretical considerations upon the structure of the two isomeric benzo-pinacolins resulting from the reduction of para-tolyl-phenyl-ketone, and accounts of experiments undertaken with this object in view. To α-pinacolin he assigns a formula analogous to that of pinacon, while β-pinacolin is regarded as being similar in structure to the pinacolins of the fatty series.

H. Brunner, "*Preliminary Notice on the Action of Silver Nitrite upon Iodo-benzyl, of Silver Nitrite and Potassium Nitrite upon Chlor-benzyl, and of Silver Nitrate upon Chlor-benzyl.*" The results obtained are as yet of no particular value.

R. v. d. Velden and E. Baumann, "*Action of the Turpentines upon Animal Organisms.*" Numerous experiments show the falsity of the statement that pure oil of turpentine, and bodies belonging to the same class, form compound ethers with the sulphuric acid present in animal organisms. Previous statements upon this subject are probably due to the fact that the turpentines experimented upon were not free from essential oils, or such substances as thymol, containing oxygen, and entering easily into combination with sulphuric acid.

E. Baumann and E. Herter, "*Action of the Homologues of Phenol upon Animal Organisms.*" The various cresols, thymol, resorcin, and other homologues of phenol, possess the latter's property of forming compounds similar to hydrogen-phenyl-sulphate on entering the animal organism. Substituted phenols possessing the character of an acid do not, however, show this reaction.

P. Hunaus, "*On Citric Acid and Aconitic Acid.*" In the course of investigations upon the constitution of citric acid the following compounds were obtained:—Trimethyl-citrate, $C_9H_{14}O_7$, by the saturation of an alcoholic solution of citric acid with gaseous hydrochloric acid, triclinic crystals melting at 79°; acetyl-trimethyl-citrate, by treatment of the preceding compound with acetyl-chloride, a colourless liquid boiling at 280°; and trimethyl-monochloro-tricarballyate, $C_9H_{13}ClO_6$, obtained by the action of phosphoric pentachloride upon the first compound, a heavy colourless oil; heating changes it into trimethyl-aconitate. Aconitic acid he obtained easily in large quantities by first leading gaseous hydrochloric acid into citric acid at a temperature of 140°, dissolving in a little water, evaporating to dryness, and then following the customary method.

A. Michael and T. H. Norton, "*Preparation and Properties of Tri-iodo-resorcin.*" Iodine monochloride added to a cold aqueous solution of resorcin gives an insoluble precipitate of tri-iodo-resorcin, $C_6HI_3(HO)_2$. The crystals obtained from a solution in alcohol or carbon disulphide melt at 145°, and are changed by nitric acid into styphinic acid, $C_6H(HO)_2(NO_2)_3$. The reaction is somewhat uncommon. Treatment of pyrogallic acid with iodine monochloride gives no results.

Otto Fischer, "*On the Phthaleins of Tertiary Aromatic Bases.*" The author has obtained dimethyl-anilinephthalein by the action of phosphoric anhydride or other dehydrating bodies upon a mixture of dimethyl-aniline and phthalic anhydride or phthalic chloride. It is of a deep green, soluble in most dissolving agents, and possesses all the properties of a colouring principle. With hydrochloric acid, picric acid, &c., it forms two series of salts, the green ones containing one molecule of acid, and the yellow two molecules. By reduction, as in the case of phenol phthalein, two atoms of hydrogen are taken up, and another new base, giving well defined salts, is obtained. Other tertiary compounds, such as methyl-diphenylamine, yield also, by the above reaction, green colouring matters.

W. Staedel and L. Rugheimer, "*On the Action of Ammonia upon Chlor-acetyl-benzol.*" Two compounds result from this reaction, both possessing the formula $C_{16}H_{13}O_2Cl$. The first melts at 117°, and is easily oxidised, yielding benzoic acid. The second melts at 154°, is more insoluble than the first, and is oxidised with greater difficulty, yielding another aromatic acid as well as benzoic acid.

T. Zincke, "*Action of Dilute Sulphuric Acid upon Hydrobenzoin and Iso-hydrobenzoin: on Pinacone and Pinacoline.*" Hydrobenzoin and iso-hydrobenzoin give each with sulphuric acid a liquid and a solid crystalline compound. Both of the liquids were found to consist of the aldehyd of diphenyl-acetic acid. The solids possess alike the formula $C_{14}H_{12}O$, have different physical properties, but identical chemical properties. From theoretical considerations the author regards these bodies as the same compound in different physical conditions, and views hydrobenzoin and iso-hydrobenzoin as identical, explaining their differences in the same manner, and placing them in the class of pinacones.

A. Blatzbecker and T. Zincke, "*On Benzyl-isophthalic Acid.*" This acid, $C_6H_5C_6H_3(COOH)_2$, is obtained from benzyl-isoxylol by oxidation with potassium bichromate and sulphuric acid. It melts at 278°. Various salts and ethers have been prepared. By reduction with zinc and hydrochloric acid benz-hydryl-isophthalic anhydride is obtained, $C_{15}H_{10}O_4$. Sodium amalgam gives the dibasic benzyl-isophthalic acid, $C_6H_5CH_2.C_6H_3.(COOH)_2$.

L. Klippert and T. Zincke, "*On Para-Xylenic Acid.*" The authors have obtained from para-dichlor-xylol, by means of the dicyanide para-xylinic acid,

$C_6H_7(CH_2COOH)_2$.

It yields easily crystallisable salts and ethers, a number of which have been prepared.

C. LIEBERMANN and M. WALDSTEIN, "*Emodin from the Bark of the Rhamnus frangula.*" An examination of the acid in the bark of the *Rhamnus frangula*, termed by its discoverer, Faust, frangulic acid, shows it to be identical with emodin, $C_{15}H_{10}O_5$. This new source of emodin allows of its being produced much more cheaply and easily than by the method now in use.

C. LIEBERMANN, "*Constitution of Oxythymoquinon.*" From the comparison of numerous closely related compounds in the naphthalin group, the author condemns the formula of Ladenburg in his lately issued work on "The Theory of the Aromatic Compounds."

C. BÖTTINGER, "*Action of Zinc-dust on the Chlorides of Sulpho-para-bromo-benzoic Acid.*" This reaction yields a mixture of the following four compounds, the separation and purification of which are attended with great difficulty:—Sulphi-para-bromo-benzoic acid,

$$C_6H_3Br(COOH)(SO_2H),$$

crystallises in fine needles, and is decomposed by heating. Sulphi-bromo-benzaldehyd, $C_6H_3Br(COH)(SO_2H)$, has an odour similar to that of the oil of bitter almonds, and melts at 131°. Hydrosulph-bromo-benzaldehyd,

$$C_6H_3Br(COH)(SH),$$

and hydrosulph-bromo-benzoic acid, $C_6H_3Br(COOH)(SH)$, are both easily decomposed.

D. ARONHEIM, "*On the Use of Molybdenum Pentachloride for the Production of Organic Chlorides.*" The joint action of this body and chlorine gas is the same as that of antimony, penta-chloride, and chlorine, forming with organic bodies highly chlorinated compounds; carbon disulphide, for example, is changed into carbon tetrachloride. It also serves admirably for the substitution of chlorine for hydrogen in benzol when the latter contains likewise substituted hydrocarbons which it is desirable to leave intact.

B. ARONHEIM, "*Synthesis of Tolyl-butylen.*" This compound, $(CH_3.C_6H_4)CH_2.C_3H_5$, one of the few non-saturated hydrocarbon substitution derivatives of benzol, is obtained from the action of allyl-iodide and sodium upon meta-xylyl-chloride. It is a colourless oil, boiling at 195°, and forming addition compounds with the halogens.

Monday, December 11, 1876.

G. KRÆMER and H. TROSCHKE, "*On Methyl-alcohol and Dimethyl-acetal.*" The authors describe methods for obtaining methyl-alcohol chemically pure, and analytical experiments on the constitution of dimethyl-acetal.

G. KRÆMER and H. TROSCHKE, "*On the Aldehyds and Ketones present in Wood-spirit.*" By submitting enormous quantities of crude methyl-alcohol to fractional distillation, the following bodies were obtained:—Methyl-aldehyd, ethyl-aldehyd, methyl-ethyl-ketone, dimethyl-ketone, amyl-ketone, and three new bodies possessing the characteristics of ketones. The first possesses the formula C_3H_6O, and is probably a condensed ketone. The next, $C_8H_{12}O$, boils at 135°, produces by oxidation large quantities of acetic acid, and by treatment with sulphuric acid yields xylol, C_8H_{10}. The third boils above 300°, yields with sulphuric acid cymol, $C_{10}H_{14}$, and receives the formula $C_{10}H_{16}O$.

C. LIEBERMANN, "*On the Formula of Brazilin.*" Brazilin, the red colouring matter of Brazil wood, has hitherto received the formula of $C_{22}H_{20}O_7$. The author considers $C_{16}H_{14}O_5$ as more correct. It possesses many points of similarity with the colouring matter of logwood, hæmatoxylin, $C_{16}H_{14}O_6$, and, where the latter, by decomposition, yields pyrogallic acid, Brazilin yields resorcin. He has prepared tetracetyl-brazilin, $C_{16}H_{10}(C_2H_3O)_4O_5$, the lead salt, $C_{16}H_{12}PbO_5+H_2O$, and halogen compounds of the general formula $C_{16}H_{12}Cl_2O_5$.

A. FRANCK, "*Action of Water on Glass.*" The author finds glass of the following composition best suited to resist the decomposing influence of steam—

$$5K_2O_3CaO_24SiO_2.$$

An easy method to determine the value of glass in this respect is to boil a finely pulverised sample for some time with water, and notice the decrease in weight. This amounts in some instances to 10 per cent.

NOTICES OF BOOKS.

Chemia Coartata, or the Key to Modern Chemistry. By A. H. KOLLMEYER, A.M., M.D. London: J. and A. Churchill.

THIS work is singular in its shape—which more nearly approaches that of a cheque-book than of any ordinary volume—a peculiarity due to the tabular form which the author has adopted. His main object has been "to compress into as small space as possible everything connected with the study that deserves attention, and to give no more explanatory matter than is actually required to render each subject perfectly intelligible," and he certainly has succeeded in condensing a wonderful amount of matter into very little space. The work is said to be especially adapted to the wants of three classes of persons: "Students intending to present themselves for examinations—to whom, as a rule, we should offer the general advice 'don't!'—secondly, persons who have learned the old notation and—not believing in the adage that a rose by any name will smell as sweet—wish to become acquainted with the *modern system*; and, lastly, those who desire to keep themselves posted on this subject, and who can thus easily refresh their memories without doing so at the expense of their other engagements."

The work, after a few introductory remarks, opens with the usual table of elementary bodies, symbols, and atomic weights. The laws of combination, the all-important subject of quantivalence, chemical formulæ, and equations are then explained. Next follows the main division of the subject.

Opposite the name of each element are placed, in parallel columns, its synonyms, its history, sources, equations (this latter term being used in a somewhat wide sense, including such directions as "Union can be effected by the aid of an electric spark passed through the mixed gases);" its properties arranged in two columns, the former containing its symbol, combining weight, specific gravity, weight of a litre, and of 100 cubic inches; and, lastly its characteristic tests. Some of the information given is, however, either defective or not happily selected. Thus under the potassium compounds we find no mention of their greatest modern source, the Stassfurt salts. The nitrates of potash and soda, we are told, occur naturally in India and Peru respectively. But when we turn to sodium chloride we find that it is "manufactured in England, Spain, and Canada." Surely it would have been more instructive to have stated that it occurs naturally in England, Poland, and North-Western India. Under aluminium we read that the white precipitate given by ammonia is insoluble in excess, which is by no means absolutely correct. The instructions for the preparation of common alum are also likely to mislead. It is prepared, we are told, from "aluminous clay"—are not all clays aluminous?—"which is roasted, exposed to air, lixiviated with water, sal-ammoniac added to remove iron, and the solution then crystallised." Under iron we read, in the column indicating its sources, "found pure and as sulphide." Why the sulphide should be named as a source for iron in preference to the oxides is doubtful.

In organic chemistry the multitude of compounds has rendered it impossible for the author to carry out his

tabular form except with certain groups, such as the alcohols and the cyanogen compounds. In general, however, space does not allow him to do more than define such classes as the ketones, amines, phosphines, &c.

The last portion of the work is a synopsis of poisons with their antidotes and general treatment.

The work upon the whole may be pronounced useful, and we hope that a future edition may see it freed from the oversights which we have pointed out, from certain typographical errors, and from the repetition of matter in different places.

Notes on Certain Explosive Agents. By Walter N. Hill, S.B., Chemist at the U.S. Torpedo Station. Boston: J. Allyn.

This work treats first of explosions and explosive bodies in general; then of nitro-glycerin and its commercial mixtures; and of gun-cotton, which, with Prof. Abel, the author regards as trinitro-cellulose, and which he distinguishes from the lower substitution products used for making collodion. Like most chemists he admits the impossibility of sulphuric acid remaining in gun-cotton after it has undergone the process of washing, directed under Abel's patent, and concurs in the conclusion arrived at in England that the Stowmarket explosion must have been caused by the intentional addition of sulphuric acid to the finished product.

The picrates and fulminates used as explosives are next described. In considering the respective forces of the agents in question he pronounces nitro-glycerin eight times as powerful as gun-powder, dynamite six times, and gun-cotton from four to six times. He draws, however, a very imporant distinction. "The harder and firmer the material to be blasted the more effective, proportionally nitro-glycerin or gun-cotton will be. In soft materials the reverse is true."

As regards comparative safety he considers both nitro-glycerin and gun-cotton to have the advantage over gun-powder.

Disease of the Sugar Cane, Queensland. By Professor Liversidge. Sydney: Gibbs, Shallard, and Co.

Epidemic disease among important crops seems to be on the increase. The potato and the vine have long been sufferers, and, according to a writer in the *Comptes Rendus* the latter is now attacked by a new malady, quite distinct from the effects of the phylloxera. The coffee plantations of Ceylon are said to be withering away from some unexplained cause, and now the sugar cane in Queensland is affected with a disease, which is locally known as "rust." Prof. Liversidge, of the University of Sydney, who has made an official examination of the diseased canes and the soils in which they grow, does not consider that the malady springs from some one specific cause, but is due to imperfect cultivation, of which he certainly points out some decided proofs.

Proceedings of the Madras Government, Public Works Department. February 21st and December 10th, 1874.

A report from Surgeon E. Nicholson on the qualities of limestones and cements.

Sanitary Effects of Eucalyptus Globulus.—Between Nice and Monaco there is a locality so unhealthy that the Paris, Lyons, and Mediterranean Railway Company have been obliged to change every two or three months the watchman at a crossing there. Plantations of the *Eucalyptus* have been formed there, and at present the same watchman has resided there for several months with his family without experiencing the least inconvenience. —*Les Mondes.*

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances, de l'Academie des Sciences. No. 21, November 20, 1876.

Physical and Chemical Properties of Ruthenium. —MM. H. Sainte-Claire Deville and H. Debray.—(See page 265.)

New Researches on the Chemical Phenomena Produced by Electricity of Tension.—M. Berthelot. —In this paper the author examines what relations may exist between the chemical actions of electricity and the sign or tension of the electricity. He finds that ozone is formed equally under the influence of positive and of negative electricity. It is formed abundantly only under the influence of strong discharges. In operating upon mixtures of nitrogen and oxygen (both moist and dry) with the Holtz machine not the least trace of nitrous compounds has been observed, although a quantity smaller than 1-50th m.grm. could have been detected. Traces have been produced with the "effluve" of a Ruhmkorff apparatus. Acetylen is formed in notable amount in the vapours of organic compounds sealed up with nitrogen in tubes containing a metallic armature, and acted on by the discharges of the Holtz machine. The absorption of nitrogen by organic compounds is effected equally under the influence of both electricities.

Composition of Certain Phosphites.—A. Wurtz.—The phosphites in question are those of calcium and of barium (acid and neutral).

Modifications of Elæomargaric Acid Produced by Light and Heat.——M. S. Cloëz.—These observations on the modifications of elæomargaric acid explain in the most satisfactory manner the curious properties of the oil of *Elæococca*. This oil contains 75 per cent of elæomargarin, the remainder being ordinary olein. On saponification the elæomargaric acid yields solid elæomargaric acid and glycerin, whilst the olein furnishes oleic acid and glycerin. In the oil congealed under the influence of light, the liquid elæomargarin is changed into solid elæostearin, accompanied with a small quantity of liquid elæolin; the ordinary olein undergoes no change. Saponification yields elæostearic, elæolic, and oleic acids. Oil heated for a long time to 180° with the exclusion of air loses the power of becoming solidified under the action of light. This is because the elæomargarin is completely transformed into elæolin.

Note on a Method of Titrating Alkaline Sulphates. —M. F. Jean.—The quantitative determination of sulphuric acid combined with potassa and soda may be effected very rapidly and exactly by means of a simple alkalimetric titration. The aqueous solution of the substance in which the sulphuric acid combined with the fixed alkalies is mixed with a slight excess of baryta water, and then with Seltz water. The excess of baryta is precipitated in the state of baric carbonate, but as the carbonic acid would be able to dissolve this salt the liquid is decanted from the precipitate, which settles rapidly; it is raised to a boil and the whole is filtered. On account of the carbonate which envelopes the sulphate and acts like starch the filtration is effected very easily. The mixed precipitate having been washed with boiling-water until the washing waters no longer present an alkaline reaction, the filtrate is mixed with tincture of litmus, raised to a boil, and titrated with a standard solution of sulphuric acid. The quantity of sulphuric acid necessary to saturate the alkalies set at liberty by the baryta water is exactly the same as what was combined with the alkalies, potassa and soda, in the original matter. The titration of the alkaline sulphates may be effected by his process as rapidly as

the alkalimetry of a sample of carbonate of soda. On operating with dilute solutions, and under the conditions indicated above, the alkaline carbonates do not decompose the sulphates of baryta. This process may be advantageously applied to the titration of the salts of Stassfurt and of Bene, so much employed in agriculture. These salts, besides the alkaline sulphates, contain sulphates of lime, magnesia, &c., which render the determination of the alkaline sulphates by ordinary methods very tedious, and necessitate a complete analysis of these salts. By the method of titration which I point out these sulphates of lime, magnesia, &c., do not interfere, since these bases are precipitated by carbonic acid, whilst only the sulphates of potassa and soda enter into solution. This process is equally suitable for the assay of alkaline carbonates, but in this case care must be taken before treating the substance with baryta water to saturate the alkali with hydrochloric acid.

On the Saccharine Matter Contained in the Petals of Flowers.—M. J. Boussingault.—The author gives a list of flowers from the petals of which reductive sugar has been obtained. Others yield invertible sugar which has no action upon the cupric liquid until after the intervention of an acid.

On a Process for the Detection of Magenta in Wines.—M. Fordos.—The author takes 10 c.c. of the wine and agitates it briskly for some seconds with 1 c.c. of pure ammonia in a test-tube. He adds to the mixture 5 to 10 c.c. of chloroform and agitates again, closing the end of the tube with the thumb and inverting several times, and finally pours the whole into a glass funnel fitted with a tap. When the chloroform has collected at the bottom of the funnel he opens the tap and receives the chloroform in a capsule of porcelain, which is then placed on the sand-bath. A small piece of white silk is then steeped in the liquid and heat is applied. As the chloroform escapes, the magenta, if present, is fixed on the silk and dyes it a rose colour. Pure wine does not dye silk a rose colour. To prove that the colouration is due to magenta it is sufficient to put the swatch of silk into a little ammonia, when the rose colour at once disappears and returns if the ammonia is driven off by heat.

Note on the Detection of Rosolic Acid in Presence of Magenta (in Wines).—MM. P. Guyot and R. Bidaux. —Reserved for insertion in full.

On Crystals of Ferrous Oxide Presenting a Singular Deformation.—M. C. Friedel.—Not adapted for abstraction.

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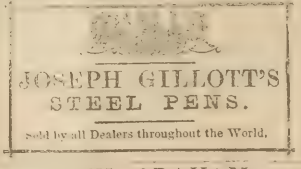

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THE CHEMICAL NEWS.

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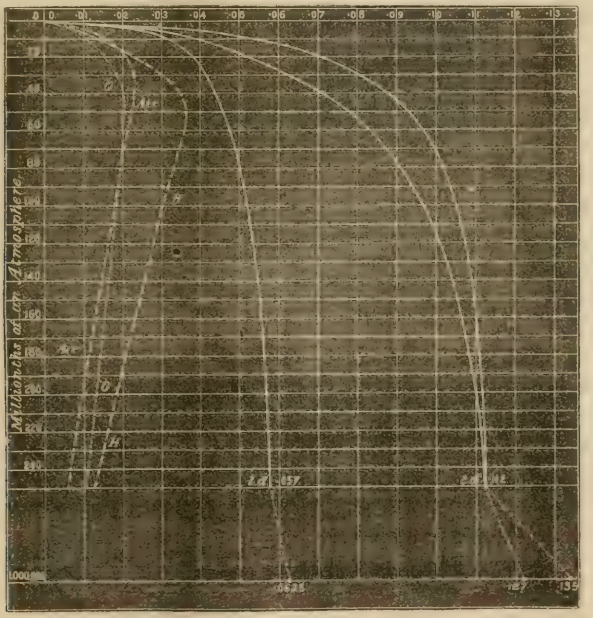
EXPERIMENTAL CONTRIBUTIONS TO THE THEORY OF THE RADIOMETER.*

Preliminary Notice.

By WILLIAM CROOKES, F.R.S., &c.

Instead of bringing another preliminary notice before the Society, I should have preferred reserving the announcement of my new results on the Repulsion resulting from Radiation until they were fit to be offered in a more complete form; but the radiometer is now so much occupying the attention of scientific men, and results of experiments with this and allied instruments are appearing so frequently in the scientific journals at home and abroad, that were I not to adopt this method of bringing the results of my more recent experiments before men of science, I might find myself anticipated in some or all of the conclusions at which I have arrived.



On June 15th last I mentioned to the Society that the repulsion resulting from radiation increases up to a certain point as I exhaust the air from the torsion apparatus. After long-continued exhaustion the force of radiation approaches a maximum, and then begins to fall off. I have since succeeded in experimenting at still higher exhaustions, and with different gases in the apparatus; and by means of a McLeod gauge attached to the mercury pump I have been able to measure the atmospheric pressure at any desired stage of exhaustion. I have not only measured the force of repulsion, but also the viscosity of the residual gas, and from the results plotted I have the observations in curves which accompany this paper, and which show how the viscosity of the residual gas is related to the force of repulsion exerted by radiation. These curves must not, however, be considered as representing more than the broad facts, for I have not included in them my final observations, which in all probability will introduce modifications in them.

In plotting these curves I have supposed my scale to be 1000 metres long, and to represent one atmosphere. Halfway up the scale therefore, or 500 metres, represents half an atmosphere; 999 metres up the scale represents an exhaustion of 1-1000th of an atmosphere; each millimetre, therefore, stands for the millionth of an atmosphere.

My results have principally been obtained at the top of the scale, and it is the last quarter of a metre which supplies the diagrams accompanying this paper.

When the residual gas is air, the viscosity (measured by the logarithmic decrement of the arc of oscillation) is practically constant up to an exhaustion of 250 millionths of an atmosphere, or 0·19 millim. of mercury, having only diminished from 0·126 at the normal pressure of the atmosphere, to 0·112. It now begins to fall off: at 200 millionths it is 0·110; at 100 millionths it is 0·[illegible]; at 50 millionths it is 0·078; at 20 millionths it is 0·0[illegible]; at 10 millionths it is 0·035; and at 0·1 of a millionth of an atmosphere, the log. dec. has fallen to about 0·01. Simultaneously with this decrease in the viscosity, the force of repulsion exerted on a black surface by a standard light varies. It increases very slowly till the exhaustion has risen to about 70 millionths of an atmosphere; at about 40 millionths the force is at its maximum; and it then sinks very rapidly, till at 0·1 millionth of an atmosphere it is less than one-tenth of

* A Paper read before the Royal Society, November 16, 1876.

its maximum. On continuing the curves of the log. dec. and the force of radiation, and assuming that the torsion fibre of glass has no viscosity, it is most probable that they both would come to zero when the last traces of an atmosphere had been taken out of the apparatus.

The oxygen diagram differs from that of air. The log. dec. is 0·126 at the atmospheric pressure; it falls to 0·111 at a pressure of 250 millionths of an atmosphere; at 100 millionths it is 0·105; at 50 millionths it is 0·093; at 20 millionths it is 0·068; and at 2 millionths it is 0·02. The force of repulsion in oxygen increases very steadily up to an exhaustion of about 40 millionths of an atmosphere; it is at its maximum at about 30 millionths, and thence declines very rapidly.

Hydrogen gives a remarkable diagram. The viscosity at the normal pressure is measured by a log. dec. of 0·063; at 250 millionths of an atmosphere it is 0·057; at 100 millionths it is 0·052; at 50 millionths it is 0·046, whence it rapidly sinks. The force of repulsion increases slowly up to an exhaustion of 250 millionths, then quickly until it attains its maximum at about 50 millionths, and it then rapidly sinks. The force of repulsion is very great in a hydrogen vacuum, being in comparison with the maximum in an air vacuum as 70 to 41. Neither is it necessary to get so high an exhaustion with hydrogen as with other gases to obtain considerable repulsion. This shows that in the construction of radiometers it is advantageous to fill them with hydrogen before exhausting.

Carbonic acid has a viscosity of about 0·01 at the normal pressure, being between air and hydrogen, but nearer the former. On approaching a vacuum the force of repulsion does not rise very high, and soon falls off.

Before working with this apparatus I thought that monohydrated sulphuric acid evoived no vapour, and I therefore freely used it for cleaning out the pump and for drying the gases. I can even now detect no vapour tension, but a comparison of the curves, with and without sulphuric acid, shows that the presence of this body modifies the results. One of my curves represents the action of the residual sulphuric anhydride gas. The experience thus gained has led me to adopt phosphoric anhydride for drying the gases. I can detect no ill effects from the presence of this agent, and I have been able in consequence to push the rarefaction to higher points than before.

The McLeod gauge will not show the presence of mercury vapour. It is therefore possible that I have a greater pressure in the apparatus than is here stated. I have, however, entirely failed to detect the presence of mercury vapour at any great distance from the mercury in the pump; and the tube packed with gold-leaf, which I frequently interpose between the pump and the apparatus, shows no trace of bleaching, and exerts no appreciable effect one way or the other on the results.

With this pump, assisted sometimes by chemical absorption, it is not difficult to exhaust a radiometer to such a point that it will not move to a candle placed a few inches off; but I have not yet succeeded in stopping the movement of the beam in the torsion apparatus.

A long series of observations have been taken, at different degrees of exhaustion, on the conductivity of the residual gas, to the spark from an induction coil. Working with air, I find that at a pressure of about 40 millionths of an atmosphere, when the repulsive force is near its maximum, a spark, whose striking distance at the normal pressure is half an inch, will illuminate a tube having aluminium terminals 3 millimetres apart. When I push the exhaustion further, the $\frac{1}{2}$-inch spark ceases to pass; but a 1 inch spark will still illuminate the tube. As I get nearer to a vacuum more power is required to drive the spark through the tube, but at the highest exhaustions I can still get indications of conductivity when an induction coil, actuated with five Grove's cells, and capable of giving a 6-inch spark, is used.

When so powerful a spark is employed there is great danger of perforating the glass, thus causing a very slight leakage of air into the apparatus. The log. dec. now slowly rises, the repulsive force of the candle increases to its maximum, and then slowly diminishes to zero, the log. dec. continuing to rise till it shows that the internal and external pressure are identical. With a fine perforation several days are occupied in going through these phases, and they take place with such slowness and regularity as to afford opportunities for getting valuable observations.

The improvements now added by Mr. Gimingham to the pump render it so easy to obtain high exhaustions that, in preparing experimental radiometers, I prefer to exhaust direct to one or two millionths of an atmosphere. By keeping the apparatus during this exhaustion in a hot air-bath heated to about 300° C. for some hours, the occluded gases are driven off from the interior surface of the glass and the fly of the radiometer. The whole is then allowed to cool, and attenuated air from the air trap is put in in small quantities at a time, until the McLeod gauge shows that the best exhaustion for sensitiveness is reached; if necessary this point is also ascertained by testing with a candle. Working in this way I can now do in a few hours what formerly required as many days. In this manner, employing hydrogen instead of air for the gaseous residue, and using roasted mica vanes set at an angle with the axis, as described further on, I can get very considerably increased sensitiveness in radiometers. I am still unable, however, to get them to move in moonlight. The statements made by an observer nearly a year ago, that he obtained strong rotation by moonlight, must therefore be considered as erroneous. My most sensitive torsion balance will, however, move easily to moonlight.

The above-mentioned facts, in addition to what has already been published, leave no reasonable doubt that the presence of residual gas* is the cause of the movement of the radiometer. But few theories are sufficiently strong not to require reinforcement, and in the present case very much remains to be ascertained as regards the mode of action of the residual gas. The explanation, as given by Mr. Johnstone Stoney, appears to me the most probable, and having stood almost every experimental test to which I have submitted it, I may assume for the present that it expresses the truth. According to this the repulsion is due to the internal movements of the molecules of the residual gas. When the mean length of path between successive collisions of the molecules is small compared with the dimensions of the vessel, the molecules, rebounding from the heated surface, and therefore moving with an extra velocity, help to keep back the more slowly moving molecules which are advancing towards the heated surface; it thus happens that though the individual kicks against the heated surface are increased in strength in consequence of the heating, yet the number of molecules struck is diminished in the same proportion, so that there is equilibrium on the two sides of the disk, even though the temperatures of the faces are unequal. But when the exhaustion is carried to so high a point that the molecules are sufficiently few, and the mean length of path between their successive collisions is comparable with the dimensions of the vessel, the swiftly moving, rebounding molecules spend their force, in part or in whole, on the sides of the vessel; and the onward crowding, more slowly moving molecules are not kept back as before, so that the number which strike the warmer face approaches to, and in the limit equals, the number which strike the back, cooler face; and as the individual impacts are stronger on the warmer than on the cooler face, pressure is produced, causing the warmer face to retreat.

I have tried many experiments with the view of putting this theory to a decisive test. The repulsive force being due to a reaction between the fly and the glass case of a

* It is a question whether the residual gas in the apparatus, when so highly attenuated as to have lost the greater part of its viscosity, and to be capable of acquiring molecular movement palpable enough to overcome the inertia of a plate of metal, should not be considered to have got beyond the gaseous state, and to have assumed a fourth state of matter, in which its properties are as far removed from those of a gas as this is from a liquid.

radiometer, it follows that, other things being equal, the fly should revolve faster in a small bulb than in a large one. This cannot well be tested with two different radiometers, as the weight of the fly and the amount of friction would not be the same in each, but I have constructed a double radiometer which shows this fact in a very satisfactory manner. It consists of two bulbs, one large and the other small, blown together so as to have a wide passage between them. In the centre of each bulb is a cup, held in its place by a glass rod, and in the bulbs is a small four-armed fly with roasted mica disks blacked on one side. The fly can be balanced on either cup. In the smaller bulb there is about a quarter of an inch between the vanes and the glass, whilst in the larger cup there is a space of half an inch. The mean of several experiments shows that in the small bulb the fly rotates about 50 per cent faster than in the large bulb, when exposed to the same source of light.

One of the arms of another radiometer was furnished with roasted mica disks blacked on alternate sides. The other arm was furnished with clear mica disks. The two arms were pivoted independently of each other, and one of them was furnished with a minute fragment of iron, so that by means of a magnet I could bring the arms in contact, the black surface of the mica then having a clear plate of mica in front of it. On bringing a lighted candle near the instrument, and allowing it to shine through the clear plate, on the blackened mica, the clear plate is at once driven away, till the arm sets at right angles to the other.

Two currents of force, acting in opposite directions, can exist in the same bulb. I have prepared a double radiometer in which two flys are pivoted one over the other, and having their blackened sides turned in opposite directions. On bringing a lighted candle near, the flys rapidly rotate in opposite directions.

Experiment shows that the force can be reflected from a plane surface in such a manner as to change its direction. If an ordinary radiometer is exposed to light the black surface is repelled, owing to the excess of pressure acting between it and the glass. If, however, a plate of mica were to arrest this force and reflect it back again, the motion should be reversed. Experiment shows that this is the case. A two disk radiometer was made, having flat opaque mica disks blacked on one side. In front of the black surface of the mica and about a millimetre off, is fixed a large disk of thin clear mica. On bringing a candle near, the molecular pressure streaming from the black surface is caught by the clear plate and thrown back again, causing pressure behind instead of in front, and the result is rapid rotation in the negative direction, the black side now moving towards the light.

To still further test this view of the action I made another radiometer, similar to the above, but having a clear mica disk on each side of the ordinary mica vane. This prevents the reflection of the pressure backwards, and causes it to expend itself in a vertical plane, the result being an almost total loss of sensitiveness.

The above actions can be explained on the "evaporation and condensation" theory, as well as by that of molecular movement, and I therefore devised the following test to decide between these two theories:—A radiometer has its four disks cut out of very clear and thin plates of mica, and these are mounted in a somewhat large bulb. At the side of the bulb, in a vertical plane, a plate of mica, blacked on one side, is fastened in such a position that each clear vane in rotating shall pass it, leaving a space between of about a millimetre. If a candle is brought near, and by means of a shade the light is allowed to fall only on the clear vanes, no motion is produced; but if the light shines on the black plate the fly instantly rotates as if a wind were issuing from this surface, and keeps on moving as long as the light is near. This could not happen on the evaporation and condensation theory, as this requires that the light should shine intermittently on the black surface in order to keep up continuous movement.

By cutting a thin plate of aluminium into the form of a spiral, then drawing it out corkscrew fashion, blacking the upper surface and suspending it on a point, a spiral radiometer is made, which rotates like a screw on exposure to light. Here also the black surface need never be in darkness, the pressure acting continuously between the black side of the spiral and the cylindrical tube in which it is mounted.

The experiments with the double radiometer of different sizes showed that the nearer the absorbing surface was to the glass, the greater was the pressure produced. To test this point in a more accurate manner, a torsion balance was fitted up with a glass suspending fibre and reflecting mirror, as described in my previous papers. At one end of the beam is a disk of roasted mica blacked on one side. In front of this black surface, and parallel to it, is a plate of clear mica, so arranged that its distance from the black surface can be altered as desired, at any degree of exhaustion, without interfering with the vacuum. This apparatus is very sensitive, and gives good quantitative results. It has proved that when light falls on the black surface molecular pressure is set up, whatever be the degree of exhaustion. At the atmospheric pressure this disturbance can only be detected when the mica screen is brought close to the black surface, and it is inappreciable when the screen is moved away. As the barometer gauge rises the thickness of the layer of disturbance increases. Thus, retaining the standard candle always the same distance off, when the gauge is at 660 millims., the molecular pressure is represented by 1, when the space separating the screen from the black surface is 3 millims.; by 3 when the intervening space is reduced to 2 millims.; and by 5 when the space is 1 millim. With the gauge 722 millims. high, the values of the molecular pressure for the spaces of 3, 2, and 1 millims. are respectively 3, 7, and 12. When the gauge is at 740 millims. the corresponding values for spaces of 3, 2, and 1 millim. are 11, 16, and 23. With the gauge at 745 millims. the molecular pressures are represented by 30, 34, and 40, for spaces 3, 2, and 1 millims. When the gauge and barometer are level, the action is so strong that the candle has to be moved double the distance off, and the pressures when the intervening spaces are 12, 6, and 3 millims. are respectively 60, 86, and 107. A large series of observations have been taken with this apparatus, with the result not only of supplying important data for future consideration, but of clearing up many anomalies which were noticed, and of correcting many errors into which I was led at earlier stages of this research. Among the latter may be mentioned the speculations in which I indulged as to the pressure of sunlight on the earth.

Hitherto most of my experiments had been carried on with bad conductors of heat. To get the maximum action of a radiometer it appeared necessary that no heat should pass through to the back surface, but that all should be kept as much as possible on the surface on which the light fell.* At first I used pith, but since learning the advantage of raising the whole apparatus to a high temperature during exhaustion, I have used roasted mica lampblacked on one side for the vanes; for this purpose it is almost perfect; being a good absorber on one face, a good reflector on the other, a bad conductor for heat, extremely light, and able to stand high temperatures. Many experiments have been tried with metal radiometers, some of the results being recorded in previous papers which I have read before the Society, but being less sensitive than pith or mica instruments, I had not hitherto worked much with them. I now tried similar experiments to the above, using the best conductors of heat instead of the worst; and for this purpose thick gold-leaf was selected for the surface on which to try the action of radiation.

An apparatus was constructed resembling a radiometer

* I have already shown that when a ray of *light* from any part of the spectrum falls on a black surface the ray is absorbed and degraded in refrangibility, warming the black surface, and being emitted as radiant heat. In this sense only can the repulsion resulting from radiation be called an effect of heat.

with an opening at the top, capable of being closed with a plate of glass. Through this I could introduce disks of any substance I liked, mounted in pairs on an aluminium arm rotating on a needle point. The first disks were of gold-leaf, blacked on alternate sides. After exhaustion, a candle repelled the black surface of one of the disks, but to my surprise it strongly attracted the black surface of the other disk. I noticed that the disk which moved the negative way was somewhat crumpled, and had the outer edge curved so as to present a slightly concave black surface to the candle. I soon found that the curvature of the disk was the cause of the anomaly observed, and experiments were then tried with disks of gold and aluminium; the latter being chiefly used as being lighter and stiffer, whilst it acted in other respects as gold.

A radiometer, the fly of which is made of perfectly flat aluminium plates lampblacked on one side, is much less sensitive to light than one of mica or pith, but, as I proved in my earlier papers, it is more sensitive to dark heat. Exposed to light, the black face of a metal radiometer moves away as if it were black pith. When, however, it is exposed to dark heat, either by grasping the bulb with the warm hand, dipping it into hot water, or covering it with a hot glass shade, it rapidly rotates in a negative direction, the black advancing, and continuing to do so until the temperature has become uniform throughout. On now removing the source of heat, the fly commences to revolve with rapidity the positive way, the black this time retreating as it would if light shone on it. Pith or mica radiometers act differently to this, dark heat causing them to revolve in the same direction as light does.

The outer corners of the aluminium plates, which were mounted diamond-wise, were now turned up at an angle of 45°, the lampblacked surface being concave and the bright convex. On being exposed to a candle, scarcely any movement was produced; when one vane was shaded off the other was repelled slightly, but the turned up corner seemed to have almost entirely neutralised the action of the black surface. A greater amount of the same corner was now turned up, the fold going through the centres of adjacent sides. Decided rotation was now produced by a candle, but the black surface was *attracted** instead of repelled. Dark heat still caused the opposite rotation to light, repelling the black surface.

The plates were now folded across the vertical diagonal, the black surface being still inside, and the bright metal outside. The actions with a candle and hot glass shade were similar to the last, but more decided.

The plates were now flattened, and put on the arms at an angle, still being in the vertical plane. When the bright surface was outside, scarcely any action was produced by a candle, but when the lampblacked surface was outside strong repulsion of the black was produced, both with a candle and with a hot shade.

Two square aluminium plates were mounted in the experimental apparatus, one being attached to the arm by the centre of one of the sides, and the other by an angle. The opposite corner of the one mounted diamond-wise was turned up at an angle. The outer convex surface of the diamond plate was blacked, and the side of the square plate facing the same way was also blacked, so that either two black or two bright surfaces were always exposed to the light, instead of a black and a white surface, as is usual in radiometers. As might have been expected both these black surfaces were repelled, but the turned up corner of the diamond-mounted plate proved so powerful an auxiliary to its black surface, that strong rotation was kept up, the square plate being dragged round against the action of light.

Folding the plates with the angle horizontal has not so decided an action as when the fold is vertical.

Sloping the plates and disks of a lampblacked mica radiometer so as to have the black outside, and consequently more facing the side of the bulb, greatly increases its sensitiveness.

The above experiments show that shape has even a stronger influence than colour. A convex bright surface is strongly repelled, whilst a concave black surface is not only not repelled by radiation but is actually attracted.

I have also tried carefully shaped cups of gold, aluminium, and other metals, as well as cones of the same materials. I will briefly describe the behaviour of a few typical radiometers made with metal cups, which I have the honour of exhibiting to the Society.

No. 1035. A two-disk, cup-shaped radiometer, facing opposite ways; both sides bright. The disks are 14·5 millims. diameter, and their radius of curvature is 14 millims.

Exposed to a standard candle 3·5 inches off, the fly rotates continuously at the rate of one revolution in 3·37 seconds. A screen placed in front of the concave side so as to let the light shine only on the convex surface, repels the latter, causing continuous rotation at the rate of one revolution in 7·5 seconds. When the convex side is screened off, so as to let the light shine only on the concave side, continuous rotation is produced at the rate of one revolution in 6·95 seconds, the concave side being attracted.

These experiments show that the repulsive action of radiation on the convex side is about equal to the attractive action of radiation on the concave side, and that the double speed with which the fly moves when no screen is interposed is the sum of the attractive and repulsive actions.

No. 1037. A two-disk, cup-shaped aluminium radiometer as above, lampblacked on the concave surfaces.

In this instrument the action of light is reversed, rotation taking place, the bright convex side being repelled, and the black concave attracted.

That this attraction is not apparent only, is proved by shading off the sides one after the other. When the light shines only on the bright convex side, no movement is produced, but when it shines on the black concave side, this is attracted, producing rotation.

No. 1038. A cup-shaped radiometer similar to the above, but having the convex surfaces black and the concave bright.

Light shining on this instrument causes it to rotate rapidly, the convex black being repelled. No movement is produced on letting the light shine on the bright concave surface, but good rotation is produced when only the black convex surface is illuminated.

No. 1039. A cup-shaped radiometer like the above, but blacked on both sides.

With this a candle causes rapid rotation, the convex side being repelled. On shading off the light from the concave side the rotation continues, but much more slowly; on shading off the convex side the concave is strongly attracted, causing rotation.

When either of these four radiometers is heated by a hot shade or plunged into hot water, rotation is always produced in the opposite direction to that caused by the light. On removing the source of heat, the motion rapidly stops, and then commences in the opposite direction (*i.e.*, as it would rotate under the influence of light), the rotation continuing as long as the fly is cooling. Chilling one of these radiometers with ether has the opposite action to exposing it to dark heat.

The vanes of radiometers have also been formed of metal cones, and of cups and cones of plain mica, roasted mica, pith, paper, &c.; and they have been used either plain or blacked on one or both surfaces. These have also been balanced against each other, and against metal plates and cones. The results are of considerable interest, but too complicated to explain without great expenditure of time and numerous diagrams. The broad facts are contained in the above selections from my experiments.

The action of light on the cup-shaped vanes of a radio-

* I use the word attraction in these cases for convenience of expression. I have no doubt that what looks like attraction in these and other cases is really due to *vis a tergo*.

meter probably requires more experimental investigation before it can be properly understood. Some of the phenomena may be explained on the assumption that the molecular pressure acts chiefly in a direction normal to the surface of the vanes. A convex surface would therefore cause greater pressure to be exerted between itself and the bounding surface of glass than would a concave surface. In this way the behaviour of the cup-shaped radiometer with both bright surfaces, No. 1035, can be understood, and perhaps also that of Nos. 1038 and 1039. It would not be difficult to test this view experimentally, by placing a small mica screen in the focus of a concave cup where the molecular force should be concentrated. But it is not easy to see how such an hypothesis can explain the behaviour of No. 1037, where the action of the bright convex surface more than overcomes the superior absorptive and radiating power of the concave black surface; and the explanation entirely fails to account for the powerful attraction which a lighted candle is seen to exert on the concave surfaces in Nos. 1035, 1037, and 1039.

NEW TESTS FOR ANTHRACEN.

By JOSEPH BENNETT BROS.

The following is a new test for the determination of pure anthracen, and also a more detailed account of the process by which the tar distillers may get a fair idea of the quality of their anthracen before it is sampled and tested by the analyst. This will save them the trouble at times of having the goods disputed on the point of quality.

In the rough sketch herewith, A is the tap-funnel containing the oxidising mixture, which drops through the half-inch pipe C, pass D condenser (containing cold water, to E) into flask H. F is india-rubber joint to prevent the water in condenser escaping: B is wire and support to apparatus; G, cork; J, wire gauze; K, stand; and L is Bunsen burner. Apparatus without stand, about 4 feet high; condenser about 2 inches diameter.

No. 1.—The oxidising solution is made by dissolving 100 grms. of chromic acid in 50 c.c. of glacial acetic acid and 50 c.c. of water. The whole is kept standing to allow the impurities to precipitate. 1 grm. of anthracen is placed in a flask fitted with a condenser, 45 c.c. of glacial acid is added, the whole is heated to gentle boil; 21 c.c. of the oxidising mixture (about 15 grms. chromic acid) is now added by degrees, and the boiling continued until finished, as in the anthraquinon test. The quinon is then precipitated and washed in the usual way. It is now washed into a dish, and dried on a water-bath. The dry residue is treated with ten times its weight of concentrated sulphuric acid (about 1·84 sp. gr.), heated on a water-bath for one hour, or until it becomes a crystalline mass by absorbing water. It is then diluted with 100 c.c. of water, thrown on a counterpoised filter, and washed, first with water, then with a 1 per cent boiling solution of caustic potash, finally with water, dried, and weighed. From the weight of quinon thus obtained subtract the ash remaining after incineration, and calculate, with the allowance, into pure anthracen by the ordinary method.

It must be well understood that this test should only be used when the chosen analyst's decision is final for percentage for value.

No. 2.—Place 1 grm. of anthracen in the glass flask, H, which will hold about 500 c.c. (through the cork of which a glass pipe with a glass condenser is fitted), add 45 c.c. glacial acetic acid; now fix in the cork with pipe and condenser, and gently boil; place in the other end of the pipe above the condenser a glass tap-funnel. Pour into the funnel 21 c.c. of the chromic acid mixture (which should contain about 15 grms. chromic acid), keep flask at gentle boiling heat, and by turning on the tap of the funnel let a few drops of the chromic acid mixture fall at intervals into the flask H, occupying about two hours in adding all: the liquid must then be boiled fully two hours longer; the heat is then shut off, and the flask with its contents allowed to stand about twelve hours in the cold. The cork with pipe and condenser is then removed, and about 400 c.c. of cold water are mixed with the contents of the flask; it is then allowed to stand for about three hours longer. The liquid is now filtered, the precipitated anthraquinon collected on the filter, washed with cold water, then with 1 per cent boiling solution of caustic potash, finally with pure hot water. The quinon is now

washed from the filter into a dish, and evaporated to dryness on a water-bath. The dry residue is now dissolved in ten times its weight of concentrated sulphuric acid (about 1·84 sp. gr.), and heated on a water-bath for one hour until it becomes a crystalline mass by absorbing water. It is now diluted with 100 c.c. of water, thrown on a counterpoised filter, washed, first with water, then with a 1 per cent boiling solution of caustic potash, finally with pure hot water, then dried, and weighed. The anthraquinon is now volatilised from a platinum crucible, and the weight of ash remaining deducted.

As a check two tests should be made at the same time, requiring, of course, another apparatus.

The anthraquinon is calculated into pure anthracen by multiplying the net weight of anthraquinon by 0·856; as, for example,—

Anthraquinon	36·050 grm.
Multiplied by	0·856 „
Gives pure anthracen, about ..	30·860 „

The allowances for ash, &c., should be left to the analyst, but this is only a small matter.

22 and 23, Great Tower Street, London,
December 11, 1876.

DESCRIPTION OF A NEW GAS-BOTTLE AND ARRANGEMENTS OF APPARATUS FOR APPLYING SULPHURETTED HYDROGEN WITHOUT SMELL, AND AVOIDING ITS ESCAPE.

By WILLIAM GRIFFIN, F.C.S.

It often occurs that the study of chemistry has been prevented in consequence of the disagreeable and noxious vapours of sulphuretted hydrogen, which is one of the chief reagents employed in the ordinary course of analysis. Few private houses contain rooms which can be furnished with the regular fittings of the laboratory, including the expensive chamber for conveying away noxious fumes. In order to obviate this difficulty I have devised the following apparatus:—

A gas bottle, consisting of three glass bulbs, one somewhat larger than the other two; these bulbs are connected by necks of about a quarter of an inch internal diameter. The larger bulb is furnished with a neck, tightly closed with an india-rubber plug, and the centre bulb is fitted with a stopcock.

To charge this gas-bottle it is necessary to fill the small bulb with diluted sulphuric acid; about one part of acid to five parts of water will be found a convenient strength. If the acid be either too strong or too weak the evolution of the gas is hindered. A piece or so of sound sulphide of iron, previously washed to remove powder and small pieces which might fall through the necks, is then placed in the large bulb, and to produce the gas the bottle is reversed, so as to cause the acid to flow from the small bulb into the large one containing the sulphide of iron which will then have the neck containing the rubber plug downwards, and be hermetically sealed by the layer of liquid above it.

When reversing the bottle it is necessary to avoid allowing the acid to run into the glass tap connected with the centre bulb. The production of gas can be stopped by restoring the bottle to its original position, which will cause the acid to flow away from the sulphide of iron.

It will be found convenient to fix the bottle by a piece of copper wire twisted round its necks, and fastened in a cork to some stand or support, upon which it may be easily reversed.

The gas-bottle is connected by rubber tubing with a cork, preferably a rubber one, containing two glass tubes, and fitting into the mouth of a very stout test-tube, about 7 inches in length and 1 in diameter. It is necessary that the test-tube should be stout, or it will be liable to break upon corking and uncorking, and it is advisable to procure several which will fit the cork bearing the gas delivery-tubes, one of which, connected by the india-rubber tube with the gas-bottle, passes to the bottom of the test-tube, and serves to convey the sulphuretted hydrogen through the liquid to be tested, and the other just penetrates the cork, and is also attached to a rubber tube, which conveys the excess of gas to the receiver in which it is to be absorbed. The test-tube is loosely fitted by means of a bung into a jar which contains hot water, as the precipitates formed by sulphuretted hydrogen are produced most favourably when the liquid assayed is kept warm. This jar also serves as a stand for the test-tube, and prevents its being upset by the twist of the india-rubber tubes. Small flasks can be used instead of the test-tubes, but, on the whole, the latter are preferable, not being so liable to upset.

The absorber consists of an upright cylinder on a foot, with a neck near the base, usually called upright chloride of calcium jar, and is connected with the second glass tube in the cork of the test-tube. This cylinder is filled with sawdust mixed with coarsely powdered sugar of lead, and it is as well if before being used it is moistened with a saturated solution of sugar of lead. The top of the cylinder is loosely closed with a cork. When not in use it may be corked up at top and at the neck at the foot. A small brush, such as is ordinarily used for cleaning tobacco pipes, will be found useful for cleaning the glass tube which leads the sulphuretted hydrogen into the test-tube, and it is convenient to have several pieces of such tubing of equal length and diameter.

When sufficient gas has been passed through an assay the gas-bottle is reversed, the tap turned off, and the rubber tube disconnected from the glass tap. A piece of the glass tubes mentioned above can then be slipped into the end of the rubber tubing, and the remnant of the gas above the assay in the test-tube blown into the absorption-cylinder.

Digestions with sulphide of ammonium can be made with the test-tube and the absorption cylinder alone.

The gas-bottle, for cheapness, can be made without the glass stopcock; in which case the rubber tube between it and the test-tube should be of two portions connected over a piece of glass tubing. When an operation is over, and the gas-bottle reversed, the piece attached to the bottle is slipped off the connecting glass tubing, and its orifice is closed with a piece of solid glass rod or a pinchtap.

German Chemical Society.—At the annual meeting of the German Chemical Society, held at Berlin Dec. 22, the following officers were elected for the year 1877:—President, Prof. F. Wöhler; Vice-Presidents, Profs. Kekulé, Baeyer, Hofmann, and Liebermann. The retiring President (Prof. Hofmann) stated in his annual report that the present number of members was 1598, showing an increase of 225, during the past year, and that 423 original scientific communications had been presented before the Society during this time twelve months. The *Berichte* for 1876 form a volume of about 1900 pages.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, December 21st, 1876.

Professor Abel, F.R.S., President, in the Chair.

After the minutes of the preceeding meeting had been read and confirmed the names of Messrs. A. Gaved Phillips and F. Kopfer were read for the first time. The President read a letter from the Secretary of the Royal Society as to the nature and conditions under which grants would be made from the £4000 given by Government in aid of original research.

The first paper, entitled "*A further Study of Fluid Cavities*," was read by Mr. W. N. Hartley, and the results of his examination of a large number of topazes selected from the magnificent collection in the British Museum showed that the cavities scarcely ever contained anything but water. If the view be accepted that topaz has been formed by the action of alkaline fluorides or cryolite on kaolin no carbon dioxide would be liberated, so that it might not necessarily be found in the fluid cavities. This is corroborated by the fact that in one and the same topaz cavities may exist side by side, one of which is nearly filled with liquid carbon dioxide, the other one-third with water, one-third with liquid, and one-third with gaseous carbon dioxide, the space occupied by the gaseous CO_2 having been produced by the contraction of the water on cooling. He inferred, moveover, that the critical temperature of water had not been reached, otherwise the contents of the adjacent cavities would have been uniform.

The author has also examined a very large number of rock sections, principally granites and porphyries, almost all of which contained water cavities, but in none of them was the presence of carbon dioxide distinctly proved. A curious phenomenon in connection with the bubbles in the water cavities of rock crystal was sometimes observed, namely, that when heated the bubble became more dense than the liquid, and sank; so that in large deep cavities they went entirely out of focus when observed with a half-inch objective. In one specimen of quartz it was found that the bubble began to sink at 150° C., but not before it had reached this temperature. The cause of this motion appears to be that the bubble consists of a gas so highly compressed that it is nearly of the same density as water at the ordinary temperature. On heating, the water expands, thus still further condensing the gas in the cavity, which then becomes heavier than the liquid and consequently sinks in it. It is very remarkable that the cavities are not only frequently arranged symmetrically around the axis of the crystal, but in some cases they take the form of the crystals in which they are enclosed, each side of the cavity being parallel to a face of the crystal. Drawings of sections of crystals were exhibited in which this was very clearly shown. This is probably caused by the water exerting a resistance to compression comparable to a solid body at the high temperature at which the crystal was formed, but being mobile the shape of the enclosed water was altered so as to conform to the planes of crystallisation of the mineral as the silica molecules grouped themselves around it.

The President, in thanking the author, remarked that this investigation in his hands had been prolific in interesting results. He hoped that his ingenious speculations, bearing on the formation of these crystalline substances and the cavities contained in them, would give rise to a valuable discussion.

In reply to a question put by Dr. Armstrong with reference to the occlusion of hydrogen by trap rocks, recently investigated by an American chemist, Mr. Hartley said that in samples of trap from the neighbourhood of Edinburgh, which he had examined, he had noticed cavities, but they contained nothing; cavities containing liquefied carbon dioxide had been observed, however, in trap. He had not considered the question as to whether such cavities contained hydrogen, his attention having been chiefly confined to quartz, granites, porphyries, &c., as most likely to have cavities containing liquefied carbon dioxide, the special object of his search.

Dr. H. E. Armstrong then gave a paper "*On Thymo-quinon*." In a recent communication to the Berlin Chemical Society, Liebermann pointed out that the "oximido-naphthol,"

$$C_{10}H_5\begin{Bmatrix}OH\\NH\\NH\end{Bmatrix}$$

of Graebe and Ludwig, prepared by the oxidation of diamido-naphthol, is more probably a compound of the formula—

$$C_{10}H_5\begin{Bmatrix}O\\NH\\NH_2\end{Bmatrix}$$

and that when it is oxidised to naphtha-quinon, the NH_2 group is displaced by OH; in other words, the OH group and one of the NH_2 groups in diamido-naphthol are concerned in the formation of the quinon, and not both the NH_2 groups as Graebe and Ludwig supposed. It is to be presumed, therefore, that in the formation of oxythymo-quinon from diamido-thymol (recently effected by Carstanjen) by oxidation, a similar reaction takes place, namely, that only one of the NH_2 groups and the OH group are concerned in the production of this quinon, the other NH_2 group being merely replaced by hydroxyl. Carstanjen has also obtained the same oxythymo-quinon by treating the monobromo derivative of thymo-quinon with potassic hydrate. Ladenburg has employed these results as the basis of a speculative theory as to the value of the several hydrogen atoms in benzene, in which he makes the perfectly gratuitous and unsupported assumption that in the first instance the thymol OH group remains unaffected, only the two amido groups taking part in the formation of the quinon; whilst in the second instance the thymol OH group does take part in the formation of the quinon. This, Liebermann points out, is not only unproved but is improbable. Dr. Armstrong stated that for a long time he had been engaged in an investigation of thymol and its derivatives, and had already obtained results which show that Ladenburg's assumption was incorrect, even if it had not been contrary to our knowledge of the law governing substitution in the phenol derivatives that para and ortho compounds are first formed. The author had found that monamido-thymol from nitroso-thymol, in which the NH_2 group occupies the para-position relatively to the OH group, yielded thymo-quinon when distilled with ferric chloride equal in weight to more than half the weight of the thymol employed in the preparation of the nitroso-derivative. He also stated that the formula suggested by Liebermann for "oximido-naphthol," &c., had already been suggested by Mr. C. E. Groves and himself in a foot-note in the new edition of Miller's "Organic Chemistry" they are now preparing, the proof sheet containing the note being handed in to the President.

The President having thanked the author for his communication,

A paper "*On High Melting-Points with Special Reference to those of Metallic Salts* (Part II.)," by Dr. T. Carnelley, was read. The method to be employed depends on the principle that if three salts, A, B, and C, whose fusion points are in the order A, B, C, be arranged on a cold block of iron, and then introduced into a muffle kept at a constant high temperature the ratio $\frac{y}{x}$ is approximately constant for the same three salts, whatever the temperature of the muffle; x being the number of seconds which elapse between the melting of A and B, and y that between the melting of B and C. The arrangement of the muffle

and iron blocks is shown in an engraving, and the methods of working given in detail. The results of a large number of experiments instituted to prove that the law just enunciated holds good under varying circumstances is given in a series of tables. The author proposes in a future communication to show how this principle may be employed in the actual determination of high melting-points.

The SECRETARY then gave an outline of a paper "*On the Estimation of Urea*," by Mr. G. TURNER, containing the results of his experiments in determining urea by Russell and West's method, the apparatus employed being a modification of that known as "Schiebler's calcimeter."

Dr. G. BISCHOF read a short notice "*On the Corrosion of Lead by the New River Company's Water*," saying that he had observed the formation of a crust of lead carbonate on the exterior of a piece of gas tube which had been employed as a syphon in a cistern supplied by the New River Company, and which was constantly alternately exposed to the action of air and water as the level of the water in the cistern altered. This tube was the so-called "composition" tube usually employed by gas-fitters, consisting of lead alloyed with a little antimony. An adjoining cistern of sheet lead with a lead overflow pipe shows nowhere any signs of similar corrosion.

In reference to a remark which the author made as to the protective influence which tin exerted when alloyed with lead, Mr. DAVID HOWARD said that even when the amount of lead in the tin used for tinning vessels employed for culinary purposes did not exceed 5 or 10 per cent it was found to be readily attacked by dilute acids, &c., so as to be likely to produce very injurious effects.

The PRESIDENT said that in the lead tube lined with tin which was made by drawing the two metals at the same time, and when faults occurred in this interior coating the lead was rapidly corroded, although no doubt the faulty parts must be more or less alloyed with tin.

The meeting was then adjourned until Thursday, January 18, when Messrs. C. T. Kingzett and H. W. Hake will give a "Preliminary Account of some New Reactions in Organic Chemistry and their Ultimate Bearing;" there will also be papers "On Kekulé's and Ladenburg's Benzene Symbols," by Dr. H. E. Armstrong, and "On Nitroso-orcin," by Dr. J. Stenhouse and Mr. C. E. Groves. Lectures are announced "On the Theory of the Bunsen Flame," by Prof. Thorpe, and "On the Discrimination of Crystals by their Optical Properties," by Prof. N. Story Maskelyne, both experimentally illustrated; they will probably take place on March 1st and April 5th respectively.

NEWCASTLE-UPON-TYNE CHEMICAL SOCIETY.

General Meeting, October 26th, 1876.

The PRESIDENT in the Chair.

PRESIDENT'S ADDRESS.

(Continued from page 270).

I MUST pass on, as time reminds me, to one or two other subjects, which, although not perhaps so strictly chemical in their nature, are nevertheless not unimportant, whether we regard them as affecting our own science or those of others. And, first, we shall all express unmistakeable satisfaction at the decision come to by our Goverment last month to take a first step—let us hope not a last—in the direction of the endowment of scientific research. You know that for some years past the sum of £1000 a year has been granted to the Royal Society, chiefly for defraying the expenses of more or less costly apparatus used in carrying out such researches as to the Royal Society should appear worthy of experiment. Within the last twelve months that sum has been supplemented by a further grant of £4000, but on a slightly different footing. Not only may the absolute expenses of research be defrayed from that fund, but such allowance may be afforded to experimenters themselves as the Royal Society may consider the researches are worth. I do not say that this is a large step in the endowment of research. I do not say that a nation like ours might not well afford to do more, and might not, perhaps, find that the operation was a far more profitable investment than the purchase of one-hundred-ton guns. But such as this £4000 a year is, we shall judge, I think, that this is a step in the right direction. I cannot, however, help feeling that there are other sources more appropriate perhaps—certainly more adequate to the occasion—to which we might have looked, and to which indeed we have looked, and looked I regret to say to a great extent in vain, for some years. Prominent amongst these, the older universities at once suggest themselves. I have extracted from blue books some figures which, I think, you will agree with me, are not altogether without bearing upon this question. Most people labour under a rather general and rather vague idea, that our older universities—under which term we include Oxford and Cambridge—are enormously wealthy. Wealthy in a sense no doubt they are; but when we come to consider their sources of wealth in detail, we find that really a comparatively small proportion of them is the property of the University. I find that the University of Oxford holds in trust for specific purposes. £15,000; applicable to general purposes, £30,000. Cambridge holds in trust £10,000 for specific purposes; and for general purposes, £23,000. We have, therefore, in round numbers, a sum of about £80,000 a-year, which is the whole income of the Universities proper. Very few people, I fancy, have any distinct idea what a very large share of the management and influence of a University really belongs to the various colleges of which they are constituted. Looking at the sums which are held by the colleges, as contradistinguished from the University, I find that the nineteen colleges of Oxford hold in trust about £35,000, and for general purposes about £330,000 a year from all sources of income. Of Cambridge, the sixteen colleges hold funds amounting to £27,000 in trust, and over £228,000 for general purposes. The grand total, then, at the disposal of the university and colleges is a little over three quarters of a million a year. Now, there is one application of part of that money which I think bears directly (although several of the others bear indirectly) upon the question of what can the universities do for research? And that application is the one known as Fellowships. I find that in all there is something like £91,000 a year expended by the two universities on the payment of Fellows, whose number is nearly the same in the two universities, and amounts in all to rather over 670. Without going into details, I do not think any one will dispute the proposition that, were the older universities really animated with the desire to encourage original scientific research, the colleges would probably apply some fraction of that sum to the endowment of research, instead of the endowment of persons. I cannot, I confess, realise the condition of mind which can conceive it is desirable that a man, simply because at the age of twenty-two or three he has passed a better examination than his fellows; simply because he has happened to show he has some capability of being henceforth useful, should be endowed with a sum of money, coupled in the majority of cases with no conditions as to future work. And I would here refer you to Mr. Vernon Harcourt's address at the Bristol meeting of the British Association for an able statement of the case from the College and University point of view. We are told in this that the universities are exceedingly anxious to endow natural science. We are told, to use Mr. Vernon Harcourt's words—"Nor have the several colleges been backward in allotting scholarships and fellowships whenever they had reason to believe that those elected for proficiency in natural science would be equal in mental calibre to those elected for proficiency in mathematics. But the universities have little power to determine what

number of students shall follow any particular line of study. With certain reserves in favour of classics and mathematics, their system is that of free trade."

But further on in his address Mr. Vernon Harcourt strikes upon a very strong, and, I think, the real, reason why the ablest men do not come up to the universities "in science:" he points out that by the time a man is eighteen or nineteen he has to a certain extent fixed his tastes, and if he has a prejudice in favour of any particular department of study, it will probably be that department to which he has been accustomed from his youth upwards, which he has always been accustomed to hear spoken of as the thing to be kept in view and to be worked at, and to which the *kudos* of his school and the prizes of his university career attach themselves from the very beginning. How is it to be expected that men, however good their brains may be, and however strong their tendency to natural science, should not be deterred from taking up, to any very large extent, or in very considerable numbers, an additional burden? They find they cannot do two things at once; and, therefore, naturally stick to the thing which has been impressed upon them from their youth, and, therefore, sink natural science, and then, I suppose, in time, we shall be told that experience shows the ablest men do not come up in natural science. I have here one or two passages from a leader, interesting, not because the paper in which it appears is one which may be supposed to know much about natural science; but because it is a paper which appeals largely to the class from which university men are drawn. It is not more than six months old, and, as a whole, will repay perusal; but here are one or two bits which especially show what he thinks of the tone of the class he is addressing:—"A first class, rank, or grade, would thus tell its own tale of merit, there would be no spurious new coinage trading upon the repute of attainments in more difficult branches of study. . . . . A classical or mathematical first is as much superior to, and as much more arduous than, a first in law, history, or natural science, as in the athletic world a university oar or cricketer puts into the shade one who only plays billiards, rackets, or puts the shot. . . . . Not to let a 'first-class man' mean anything from a student in 'stinks and bones' (as the school of natural science is irreverently called at Oxford) to a really talented classic or mathematician, and not to allow silver and alloy to claim equal prestige and value with a pure gold coinage."

I think if this is the atmosphere which pervades our older universities (though I should hope we should hardly find such utter ignorance in anything higher than freshmen) we can hardly wonder that natural science is not much in favour there, and hardly expect that many of the real prizes should be reserved, at any rate for some time to come, for natural science. Looking at the fact that we have had an addition to the national taxation, in order to endow research, you will agree with me that the time is coming when it may be well for the bodies which devote these sums mainly to the encouragement of classics and mathematics to set their houses in order in this respect. There are already some slight signs, we are glad to see, of this setting in order being set about. There is one college at least—I dare say some of you will identify it at once—in Cambridge, where the endowment of research has already become a thing of the present instead of the future—a college where at least one fellowship has been given, not simply on the strength of a man having passed a magnificent examination, which may be worth little or nothing, but on the strength of his having shown promise of original research in a special direction—a promise which one is glad to know has been already fulfilled by his subsequent career.

You are probably aware of the remarkable letter which appeared in the CHEMICAL NEWS in January, in which our ex-secretary, Dr. Wright, revived a question which had before agitated the minds of chemists—the question of organisation amongst professional chemists. I should waste time were I to recapitulate all the discussion which has taken place in the columns of the CHEMICAL NEWS and elsewhere—a discussion which unfortunately has served chiefly to mix up two subjects which were not necessarily related to it. That organisation amongst chemists is desirable we shall all, I think, unanimously agree: that something should be done to prevent dabblers in chemistry, who have picked up a little, and generally a very little, of the practical chemistry connected with what they are pleased to consider their own particular work, styling themselves professional chemists, or applying for official positions of trust—in that we shall all be agreed. But to mix up with this question, the other question, equally important as it is, of the status of the fellowship of the London Chemical Society, is, I think, unnecessary. The case as to this latter question admits of being put exceedingly briefly from two sides of view. One party say the outside world believes that the addition to a man's name of the initials "F.C.S." means something; that that addition really means nothing except that the bearer has been guaranteed by five proposers as likely to pay his subscription with tolerable regularity; and, that these things being so, many people believe that the title will persuade outsiders that they are, what they are not in reality, competent professional chemists. This is one side of the question. On the other side it is contended, and contended with all the weight of official authority, that nobody ever did believe that "F.C.S." meant anything; that at any rate it was never intended to mean anything beyond the fact that its bearer took more or less interest in chemistry; and that if all who claim the title, who have no title to it, were excluded, that would be found to prejudice, financially, the interests of the Society's Journal. That is, I think, a fair statement of the two points of view which have been put forward in the CHEMICAL NEWS and elsewhere. Now, with each of these, contradictory as they may seem at first sight, one is very much inclined to agree; and looking to the fact that it would be impossible, at any rate, to make any action which the Chemical Society might take retrospective, one is inclined to think that the abusers of the title might be better dealt with by the powers which the Council at present possess for dealing with such offenders through the bye-laws. I am glad to be able to say that there is every probability that within the next few weeks a scheme will be brought forward, publicly, by the gentlemen who instituted the discussion for forming an organisation which shall, more or less effectually, deal with this question. I believe my own views are somewhat in advance of what the proposers of the organisation endorse. They may possibly be in advance of the views of a good many; but nevertheless they are my views, and I venture to put again before you the suggestions which I advanced two years ago, that this organisation, guild, institution, whatever you please to call it, will be powerless for good, except within very narrow limits, as long as it remains a semi-private body; and that what is really required is legal endorsement and legal power to deal with the questions of professional education and examination. I should spend not one hour but two if I went into the consideration of all the details and all the difficulties of the question; and, therefore, I will not further allude to it.

CORRESPONDENCE.

A NEW PROCESS FOR THE ESTIMATION OF CHICORY IN COFFEE.

To the Editor of the Chemical News.

SIR,—I send you the following process for the estimation of chicory in coffee which I have tried with success:—Take 5 grms. of the coffee and pour upon it about 25 c.c. of boiling water and filter; then pour it into a Nessler

tube, and add acetate of lead, which will throw down the colouring matter of the coffee but leave that of the chicory, which can then be estimated by comparing it with a standard of a known quantity of chicory.—I am, &c.,

ALBERT SMITH.

198, Essex Road, Islington.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Journal of the Russian Chemical Society, November, 7, 1876.

Ethyl-isopropyl-ketone.—D. Pawloff.—Preparation and properties of this compound, $C_6H_{12}O$.

Trichloral-cyanide.—C. Cech.—A concentrated solution of potassium cyanide added to a saturated aqueous solution of chloral hydrate causes the gradual appearance of a crystalline body, possessing the formula $C_7H_4NCl_3O_3$, and formed by the union of three molecules of chloral with one of hydrocyanic acid. Dry distillation yields chloral and chloralide.

Preparation of Dichloracetic Acid from Chloral.—C. Cech and P. Schwebel.—The experiments described are entirely of a negative character.

The Mutual Solution of Liquids.—W. Alexejeff.—Among various experiments upon solubilities, the author has found that the solubility of water in phenol and of phenol in water increases rapidly at 80°, and that at 84° both liquids can be mingled in all proportions.

Pyro-tartaric Acids, Normal Oxy-pyro-tartaric Acid, and the Isomery of the Pyro-citric Acids.—W. Markownikoff.—The author finds that by the distillation of the four pyro-tartaric acids the normal acid is undecomposed, the methyl-succinic acid changes into the anhydride, while ethyl-malonic acid and dimethyl-malonic acid lose carbonic acid, and are changed into butyric acid and isobutyric acid. A comparison of the melting-point of isomeric compounds shows that it is raised by an increase in the number of side links in the molecule.

Investigation of the "Adonis Vernalis."—T. Lindros.—The author has detected the presence of aconitic acid in the leaves of the *Adonis vernalis*.

Application of the Electric Current to the Study of the Spheroidal State.—M. N. Hesehus.

An Experiment on the Polarisation of Electrodes.—M. R. Colley.

Les Mondes, Revue Hebdomadaire des Sciences, No. 8, October 26, 1876.

This issue consists of an abstract of the *Comptes Rendus* for October 16, and contains no original chemical or physical matter.

No. 9, November 2, 1876.

A school of anthropology has been opened in connection with the Faculty of Medicine at Paris.

A renal calculus taken from a patient of M. Laborde has been found to contain 75 per cent of ferric oxide.

On the Various Theories to which the Radiometer has given rise.—M. G. Lippmann.

Weight of an Atom of Hydrogen.—M. Annaheim.—The author dissolved 0·0007 grm. of magenta in alcohol and diluted the solution to 1000 c.c. In each c.c. of the liquid there was then 0·0000007 grm. of colouring matter. The liquid thus obtained is poured into a burette of 1 centim. in diameter, and appears decidedly coloured if seen against a white ground. If a drop from the burette, of which 35 go to a c.c., is poured into a small test-tube of 0·8 centim. in diameter the colour is still visible if regarded against a sheet of white paper, along with a drop of pure alcohol in another similar tube. Hence the eye can detect 0·000000002 grm. of magenta. If we suppose that this drop contains only a single molecule of magenta it follows, according to the formula of this colour, that the absolute weight of an atom of hydrogen cannot exceed 0·000000000059 grm., but may fall below this number.

No. 11, November 16, 1876.

Saccharimeter or Polarimeter.—By M. Laurent.—The peculiarities of this instrument cannot be made intelligible without the accompanying diagrams.

Treatment of Sewage.—M. Gerardin.—This paper is devoted to the praises of a secret remedy accidentally discovered by a certain M. Knab. No light is thrown upon its nature and composition, but it is pronounced a better precipitate than sulphate of alumina, with the strikingly contradictory addition that it merely acts upon suspended and not upon dissolved matter.

Reimann's Farber Zeitung. No. 38, 1876.

Aurantia.—This beautiful orange dye, according to Gnehm, of Zurich, is the ammonia-salt of an acid, which he has described under the name of dipicrylamin. The colour was first manufactured by Bindschedler and Busch, of Bâle, about the end of 1874. This firm, however, has ceased manufacturing the colour, because the salts of the acid in question exert a powerfully irritating action upon the human skin, and occasion eruptions resembling those produced by the application of croton oil. This action, however, depends on idiosyncrasy; *i.e.*, whilst some persons are strongly affected by very dilute solutions, others experience nothing unpleasant from contact with the concentrated liquid.* On the other hand, C. A. Martius remarks that the aurantia prepared by him does not give rise to this phenomenon, and that the experiments undertaken by Salkowsky in the Physiological Institute of the University of Berlin prove the colour to be innocuous. The injurious effects of the Swiss samples must therefore be traced to an impurity. Aurantia, as appears from its composition, is violently explosive, and should be kept slightly moist with glycerin.

* A similar variation is observed in dye works as regards the action of the chromates upon the skin. Certain men are physically unable to dye chrome-blacks on account of the injury to their hands.—*Ed.* C. N

MEETINGS FOR THE WEEK.

MONDAY, Jan 1st.—London Institution, 5.
TUESDAY, 2nd.—Zoological, 8.30.
WEDNESDAY, 3rd.—Microscopical, 8.
THURSDAY, 4th.—London Institution, 7.
FRIDAY, 5th.—Geologist's Association, 8.

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